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# ON

# WOUNDS AND INJURIES

OF THE

# ARTERIES OF THE HUMAN BODY;

WITH THE

# TREATMENT AND OPERATIONS

REQUIRED FOR THEIR CURE.

ILLUSTRATED BY 130 CASES, SELECTED FROM THE RECORDS OF THE PRACTICE OF THE MOST CELEBRATED SURGEONS IN EUROPE AND AMERICA, WITH THE CRITICAL REMARKS OF THE AUTHOR ON EACH.

BY G. J. GUTHRIE, F.R.S.

*LONDON:*
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THE following Lectures were given for the purpose of showing the erroneous nature of the opinions entertained by many Surgeons, even of the present day, with respect to the practice to be adopted in cases of Wounds and Injuries of Arteries; and with the view of demonstrating and firmly establishing the fact, that the practice recommended and generally pursued during the latter part of the war in Portugal, Spain, France, and the Netherlands, is the only one which can be followed with safety and success. It will be a consolation to those who labour in the great work of diminishing the ills to which mankind is subjected, to know, that some good has in this instance, resulted from evil; that the knowledge which has been thus derived from one of the most sanguinary, distressing, and eventful struggles recorded in modern history, is and will be pre-eminently useful in saving the lives of many for ages yet to come.

4, BERKELEY STREET, BERKELEY SQUARE.
July 14th, 1846.

# LECTURES

ON SOME OF THE MORE

# IMPORTANT POINTS IN SURGERY.

## PART I.

## ON WOUNDS AND INJURIES OF ARTERIES,

WITH THE

## OPERATIONS REQUIRED FOR THEIR CURE.

### INTRODUCTORY LECTURE.

Gentlemen,—I have long promised to write one or two more books in connection with the many different points in surgery which I have already noticed. My record of the "Surgery of the Peninsular War," for instance, is incomplete. That part which relates to the injuries of the chest, the abdomen, and the pelvis, is scarcely known except to those who formerly attended my lectures; and the consequence is, that many students are unacquainted with the improvements introduced into the treatment of them during that war, although thirty years have since passed away. Many of the gentlemen who come before me at the Court of Examiners of the College of Surgeons are exceedingly ill-informed on these subjects, although they have fairly studied many others. Some do not even know when a man is stabbed on the right side of the chest, whether he should lie on that side, or on the other, or on his back, and even if they should answer correctly, it is by no means uncommon for them not to be able to give a reason for the selection. If they seldom know this, the very first step to be taken in the treatment of these injuries, it may readily be inferred how little likely it is, that they should know other and succeeding parts more accurately. I can safely say that scarcely one student I have examined, in the eighteen years I have been an examiner, has been able to tell me the proper treatment to be pursued with regard to an incised wound in the chest, into which the lung had protruded, even if he were able to describe what ought to be done when it had not. When I was first elected into the Council of the College of Surgeons, an honour conferred upon me at an earlier period than had ever befallen any other person, not on account of any merits of my own, but from the reflection of those of others which I had been the means of placing on record, the elderly gentlemen were, it is said, but little acquainted with these injuries. Sir Peter insisted that every man should be bled, because he had the misfortune to be stabbed—Sir Roger, that he should be thoroughly physicked, in order to allow of a free descent of his diaphragm—and Sir Richard was for keeping his wound open, that the secretions might readily flow out, until the proper time for duly closing it should arrive. If the bleedare, the purgare, and the clysterisare system did not suffice, it was admitted that there was nothing better to be done than to rebleedare, repurgare, and reclysterisare, as Moliere and his associates had recommended to be done before. The grinders of the present day instruct their aspirants to close such wounds without delay, to eschew calomel and jalap as incompatible with the absolute rest such cases require, even if the diaphragm should not descend with perfect freedom, and teach them not to bleed in expectancy.

Wounds of the abdomen were not in more fortunate consideration. The elder surgeons brought the edges of a cut in the wall of the belly of three inches in length, into some sort of apposition by two stitches of several good thick threads, introduced at equal distances through the muscles down to the peritoneum, but woe to the man who thought of touching this inner lining. Having been thus stitched up, which was of itself enough to aid him out of this world—if the accident itself had not been sufficient—he was then to be thoroughly well physicked, and bled ad libitum.

An accomplished grinder now disapproves as much of a stitch in a muscle as the surgeons of old did of one in the peritoneum, and as he crams in turn his expecting students with the peculiar doctrines of Mr. A. or B., he teaches them to sew up the skins, and the skins only of their patients, exactly as their mothers would do a hole in their best pocket-handkerchiefs. He inveighs against salts and senna, and protests that they do not accord with that state of quiescence which can alone save the patient.

Surgery has followed in the wake of other things, and has yielded to the dictates of experience, founded on observation. It has been, however, somewhat slower in its progress than other matters of science which are commonly valued at a higher rate, than the art of saving life.

Gentlemen who have accidentally seen one or two cases of wounds of the chest, have sometimes thought themselves at liberty to lay down what they call principles to be followed in all cases of the kind; and it has been a matter of surprise to many to find their precepts doubted by those who have had greater opportunities for observation than themselves. Few, like my late learned friend, the professor of military surgery in Edinburgh, have the candour to acknowledge the erroneous nature of the opinions they had been taught, or the honesty to avow that they were altered. I think it was a Whig Government that created, very many years ago, the office of professor of military surgery in the University of Edinburgh, to reward the services of a zealous medical supporter, resting their defence of the new appointment upon the grounds that the individual in question, being a civilian who had never seen a shot fired, nor any sort of military service, was at least open to conviction and improvement—that he was a sort of tabula rasa, as far as experience was concerned. The professor was really a learned and a most honourable man, and an able surgeon, and taught what he did know in a manner which gained him universal approbation. Nevertheless, there were some things he did not profess to know too well; and when the battle of Waterloo was fought, he was glad to avail himself of such an opportunity of acquiring information, and hastened to Brussels, with a full recollection in his mind of Mr. J. Bell's work on Wounds of the Chest, which he had particularly studied and admired. One part of this treatise is elaborately written; the description of the inflation of the whole of the cellular membrane of the body, which ensues after a gun-shot wound of the chest, is so truly graphic, so beautifully described, that it is even now frequently referred to as an admirable specimen of surgical writing. An unfortunate man, lying with a musket-ball in his chest, and gradually swelling up, until he parodies in appearance the ambitious frog in the fable, naturally attracted the sympathy, and lived in the recollection of every one. When the learned professor reached Brussels, his first question to me was, "Did you see many of the cases of emphysema so well described by Mr. John Bell in his admirable book on wounds, when you were in the Peninsula? How many are there here? You must have heard of every good case—do show me some of them." I replied, with all becoming gravity, that the last case I had seen of general emphysema was at Tarbes, after the skirmish which took place in front of that town. A poor creature was brought into the square before my door, one morning, apparently dead. He was carried by three men, with long white sticks in their hands, followed by a fourth with a pair of bellows. The three first had scarcely put him down, when to my astonishment they began to strike him smartly with the sticks, and the fourth, before I could get down to interfere in his behalf, had cut a hole in his skin, near the bottom of his back, into which he introduced the muzzle of the bellows, and in an incredibly short space of time had blown him up to twice his natural size. The incredulity shown by the worthy doctor at this relation of my case rendered it necessary for me to explain that the patient was a calf, and that the four butcher boys had in three minutes fairly outdone John Bell. The professor and the friends who accompanied him declared I was laughing at them, and could scarcely credit my assurance that I had never seen such cases as the late Mr. J. Bell had described, and that they would nowhere find them, except in Mr. John Bell's book. The doctor was, however, easily satisfied they were not to be found in Brussels. He soon understood that a musket-ball makes too large a hole to admit of such a thing taking place, although it possibly may occur from a stab, or small hole, which may not prevent the closing of the external opening, whilst the inner wound into the cavity of the chest, communicating with the lung, remains pervious. The learned professor smiled on hearing this explanation, and said, "I am afraid I have much to learn, and more to unteach"—an acknowledgment which did him honour. He remained at Brussels long enough to make an epitome of all the interesting cases he saw, which he published on his return, and by it gained great credit. The result to himself was not bad, and there is certainly no ill-will in the story, although perhaps there may be some little satire in telling it. The Tories were in office on his return, and were determined not to be outdone by the Whigs, in rewarding a meritorious servant. They thought that as their political opponents had made him a professor when he knew but little of the subject he was to teach, something ought to be done for him when he had well qualified himself for the office. They therefore made him a staff-surgeon, the full pay of which he enjoyed for a long time, and the half pay until his decease. You may learn from this anecdote, that a good surgeon and a zealous politician are sometimes not incompatible nor disadvantageous qualifications.

There are few occupations more troublesome than printing or publishing books when the stimulus of necessity is wanting, and when the subject precludes all hope of pecuniary profit. My publishers, for instance, persuade me to pay for the paper and printing of a book, as a first expense, and then to allow them 10 per cent. commission for taking care of it, which, together with 30 per cent. allowance to the retailing booksellers, with the additional advantage of receiving thirteen as twelve, make 50 per cent., leaving 50 to pay for paper, printing, and advertisements. Direct profit is not therefore to be thought of from a book on wounds, &c.; the indirect profit, it is said, might be incalculable, if people were not so seldom shot or run through the body as to indispose them to buy books which treat of such matters. I willingly pay for a book that people will buy on more common complaints, or accidents in which they may be immediately interested; but I have been careless of doing so for those which are not likely to pay either directly or indirectly. I now content myself by allowing my opinions to appear before the public through the medium of such of the weekly medical journals as may please to publish them.

The treatment of wounded arteries is not better understood by students in general. They can all answer that a ligature ought to be placed above and below the wound in the artery, or on both of its ends when divided; but try them on the means to be adopted in a punctured wound of the axillary artery, or of the femoral, or in a case of wound of the calf of the leg, in which it is doubtful whether one or both of the arteries are injured, and they are lost. If they fly for assistance to Mr. Hunter's theory for the cure of diseased arteries, they will find a method of proceeding which is never successful when put in practice for a wounded artery, or at least so seldom successful as to form only an exception to the general principle already mentioned, and which can never be departed from without imminent danger to the limb, if not to the life of the patient. It is not less extraordinary than true that different principles, as they are called, are taught in different schools of surgery in London, and my examinations on these points frequently become courses of instruction, instead of inquiry, and I am in consequence obliged to exercise a leniency, when about to pronounce sentence of approval or rejection, which often materially interferes with my sense of public duty.

Anatomy has its little differences as well as surgery. The learned professors of school No. 1 teach that a femoral hernia descends into the sheath of the femoral vessels. The no less learned professors of school No. 2 declare that it is on the contrary, projected against the part only which is going to form the sheath, and that it descends in a separate tunic of its own, by the side of, but distinct altogether from, the sheath of the vessels. With these gentlemen I concur in opinion. The very able professors of school No. 3 teach that this same femoral hernia comes out in the thigh at the saphenous opening. The equally able professors of school No. 4 declare that it has little or nothing to do with the saphenous opening; to which opinion I assent. The most perfect of grinders cannot get over this. He is obliged to beat two opposite opinions into the heads of his *élèves* in the morning, and two more in the afternoon, that he may be able more conveniently to cram them again all round with the whole four in the evening. How can this be settled? One of the medical bills lately introduced into Parliament, but which did not long remain there, provided for the establishment of a Council of Health, so called on account of its having nothing to do with the health of any one person whatever, but which name was possibly selected because no one could suspect that, to a body constituted under so unassuming—nay, benignant—a title, powers were to be granted of a more arbitrary and oppressive nature, more subversive of the rights and best interests of individuals than any which have been conveyed by any other act of Parliament. One of the clauses of this bill empowered this council, or medical inquisition, as it ought to have been called, to ascertain whether the examiners of the different colleges did their duty to the satisfaction of the council. If they had not done so, men of only ordinary minds might perhaps have thought it right to give authority to the council to admonish the examiners. The authors of this bill thought otherwise. They empowered the council to punish the students, to refuse them (although declared competent by the examiners) their authority to practice, without which they could not legally do so; and thus, in fact, to destitute them, to turn them out to starve, until the examiners should acknowledge their errors, and amend their ways. If any of these bills should re-appear, I will do my endeavour that a clause shall be inserted by which these anatomical differences may be quickly adjusted, and the provision to be made for this might be, "that until the professors can agree upon anatomical facts which admit of clear and easy demonstration, the students shall be annually whipped, at the end of each session"—one clause being a *pendant* to the other.

The war in the Peninsula terminating, it may be said, by the battle of Waterloo in Belgium, added much to the character of the British army, and to the military renown of the nation, whilst the miseries caused by, and attendant upon it, have led to the improvement of the art and science of surgery in a degree which neither could or would have been effected without them. My late friend, Sir Astley Cooper, took pleasure in declaring that the practice of that war had given to surgery its greatest impulse in the present century, and the admission showed an honesty and nobleness of disposition it would well have become others to have imitated.

Engaged from the first battle on the heights of Roliça, to the last of Toulouse, and subsequently at Waterloo, generally in the field, or in charge of a principal part of the wounded afterwards, there was no one who, from his labours or his opportunities, had a better right to take upon himself the humble office of recorder and historian of the surgery of that war. When I undertook this duty, thirty-one years ago, I laboured under one great defect, to say the least, which time has however removed. I was not twenty-nine years of age. I had wrung from the authorities at home the inspectorial rank I held by dint of hard work alone, and I was afraid of giving offence to those I had distanced in the course by assuming anything to myself. Nothing, therefore, could be more humble and unassuming than the expression of my views in the first and second editions of my book on Gun-shot Wounds, and the Operations of Amputation. They were followed by so much change in the opinions of the profession on the points to which they adverted, that whilst few objected, and none refuted, some were not ashamed to appropriate an improvement or two as their own, and to sneer at what they were not equal to disprove, or to overturn. In 1827 I published the third or greatly enlarged edition of my treatise on Gun-shot Wounds, on Inflammation, on Erysipelas and Mortification, on Injuries of Nerves, and on Wounds of the Extremities requiring the great operations of amputation of the hip-joint, shoulder-joint, &c., with a preface, in which I *then* felt it right towards the medical officers of the army to claim for them the improvements they had introduced. It is as follows :—

When I printed the first edition of this work, in 1815, I stated, that it contained " many opinions in opposition to those received in common by the profession, and even now taught." I also said, that in publishing them I was desirous of making known " what had been the practice of the surgeons of the British army during the Peninsular war, and to preserve for them the credit of the improvements which they alone have introduced into the science and art of surgery, and particularly in the operative part, in which they have been eminently successful." In referring to my professional brethren that credit which was their due, I by no means wished to exonerate myself from any blame that might be attached to the practice recommended, for I was aware that some of these opinions were not common to the whole, and for those in particular, as well as for every one of them, I held myself responsible. I was contented to allow them to find their way as unobtrusively as possible into the world, satisfied they would stand the test of investigation, and be ultimately adopted as principles. In this I was not mistaken: they have not only been generally adopted, but pirated by some persons, and even advanced as something new by others, many years after I had published them. In order to put a stop to such proceedings I shall now enumerate those points in which surgery is indebted for its improvements to the medical department of the army and the practice of the Peninsular war; and in doing so I trust I shall redeem the pledge given to the medical officers of the different branches of the public service in the introductory lecture to my first course of lectures on surgery, in 1816, that I would always defend and maintain their right to the improvements they first suggested or made against all encroachment."

"Previously to the termination of the war in 1813, and the appearance of the first edition of this work, the opinions of Mr. Hunter on the powers and capabilities of the human constitution were invariably received. As general principles they did little mischief; but when they came to be acted upon, the results were not found to coincide with the principles from which they were deduced. When an injury had occurred to a person in health, rendering the loss of a limb necessary, he recommended that an operation should not be performed until after suppuration had been established, a period, probably, of six weeks, which, even if the patient survived, was often found to be too late to be serviceable."

" From the failure of this practice, the contrary one of immediate amputation, became gradually more general during the war, and at its close I not only advocated and established the propriety of it, but examined the reasoning on which Mr. Hunter's opinions were founded, and I trust have proved it defective. That it was so ought indeed to be presumed, when the facts were found to be opposed to the reasons."

" It was not, however, on the single point of amputation that this reasoning led to error, it embraced the whole subject of inflammation and its consequences, which I believe can only be consistently viewed on the principles regarding the human constitution which I have advanced. The variations in the nature and appearances of erysipelas may through them be more easily comprehended, and the treatment of mortification more scientifically undertaken. The Baron Larrey has shown, in opposition to the received opinions of the schools, that in gangrene from wounds, amputation might occasionally be resorted to with success during its progress; but he did not explain that this was entirely dependent on the circumstance of its being local. The division I have made into constitutional and local mortification, and the practice I have indicated to be followed in the different species of gangrene, from whatever causes they may have originated, as dependent on this distinction, are improvements which many are inclined to adopt, without being aware to whom they are indebted for them. There is still, however, in some, an unaccountable slothfulness in neglecting all inquiry into this subject, whilst there is in others an obstinate adherence to the old practice, although unsuccessful."

" The practice of the Peninsular war led, however, to another important result in surgery; it dissipated that delusion which had so long obtained possession of the minds of surgeons of every description, ' that it was impossible to command the flow of blood through the great arteries.' I overturned at once this hypothesis—declared it to be visionary, and not only without foundation, but the reverse of fact. On the return of the medical officers of the army to London, in 1814, it was not a little amusing for them to hear teachers of surgery gravely informing their students that amputation at the shoulder-joint was a most formidable operation, on account of the impossibility of effectually preventing the flow of blood through the arteries; and when they did notice amputation of the hip-joint, it was only to declare it a murderous operation. What is the state of things now? What has the short space of twelve years done for this branch of surgery? Why almost too much. The facility with which these operations can be performed, and the safety which attends them, has been shown, and all alarm has been banished from the minds of surgeons on these points. It is now to be feared that they may become unmindful of the precepts I have laid down demonstrative of *their necessity*, and recommend them to be performed when others less important might suffice."

"The practice of the Peninsular war was decisive on many other points. It overturned the application of the theory of aneurism to the treatment of wounded arteries, and my paper on wounded arteries, published in 1811 in the new *Medical and Physical Journal*, demonstrated the necessity which existed for performing the operation at the wounded part of the vessel, and not at a distance. It showed, what is not yet well understood by many, that in no case (and this is without exception) should one ligature above the wound in an artery be depended upon, but that another should be applied, if possible, below it."

"I have proved from official documents that the great dread entertained of secondary hæmorrhage in gun-shot wounds was groundless, whilst the practice in all cases has been established on more certain principles than before."

These and many other minor points I do not think it necessary to notice. A careful examination of the books which existed at the commencement of the Peninsular war, and a comparison of them with the observations there made on the same subject will show in what part the alterations and improvements have taken place, whilst the work, from its continued reference to the different periods of the war, demonstrates the fact of the particular time at which each of them was established, if it does not mark that at which they originated"—June 18, 1827.

The experience of the last thirty years in London, during which time I have enjoyed a share, I fear beyond my deserts, of hospital and of private practice, has confirmed the accuracy of these statements, and although I trust some improvement will yet take place in many until they attain perfection, I shall not be disposed to abandon one of them until a superior degree of information on these points be shown, which at present I do not anticipate, but which I shall most gladly acknowledge.

There is not, in fact, one word in that preface which is not true. Since 1827 nearly all my old friends and fellow labourers have passed away. I am the more bound to protect their memories. There are none to be annoyed by any stories I may now tell, by any errors to which I may allude. They have long since expressed their sense of the services they were pleased to say I had rendered them by my records and lectures, in the kindest and most liberal manner, and although I have been careful to claim little as personal to myself in all I have written, or shall do in what I have yet to write, or to say, no one of them has disputed, nor will any of those who remain dispute any assumption I may make as to how much or how little is my own.

Professor of Anatomy and Surgery to the College of Surgeons during the four years ending in 1831, I published the principal part of the lectures I had delivered during that time: On the Diseases and Injuries of the Arteries of the Human Body; on the Operative Surgery of the Eye; on some Points connected with the Anatomy and Surgery of Femoral and Inguinal Hernia; on the Anatomy and Diseases of the Urinary and Sexual Organs. In 1833: Lectures on the Treatment of Compound and Gunshot Fractures of the Extremities; on Excision of the Head of the Thigh-bone, the Arm-bone, and the Thigh-bone. In 1841, again Professor of Anatomy and Surgery to the College: on Injuries of the Head affecting the Brain. Very early I had recorded an improved method of Treatment of Syphilitic Diseases without Mercury, &c. Some of these books have gone through three editions, and most of them are out of print.

In the course of the lectures I am about to give in this and the ensuing year, I hope to be able to draw your attention to all the points I have hitherto omitted, and to advert to many of those I have noticed which appear to be of most importance. I shall begin with the injuries and wounds of arteries, including the operations required to their cure, with the hope of attracting the attention of surgeons and students more fully to the essential points to be observed in their treatment. These will be followed by an inquiry into the wounds and injuries of the chest, the abdomen, and the pelvis, with the operations required for breaking up, and for extracting a stone from the bladder.

It may be, in conclusion, some satisfaction to you to know, and it is not less satisfactory to me to declare, that none of the opinions I have advocated on behalf of my old friends, most of whom are no more, are disputed or disallowed by any of my colleagues of the Court of Examiners of the College of Surgeons, as far as I am at present aware. There is no practical point positively recommended which all of them have not admitted, and have required all students to acknowledge, up to the retirement of my old friend, Mr. White. That some of these opinions may hereafter be found capable of improvement, and requiring alteration, I am willing to admit. All I desire of you now is, that you will believe, until opportunities for observation shall occur, which may enable you seriously to doubt.

# LECTURE I.

*Wounds and injuries of arteries; Structure of arteries; External coat — Internal — Middle; Fourth coat of Haller and Malgaigne; Efforts of nature in healing wounds of arteries; Effects of small puncture; A large puncture; Case of puncture of the ulnar artery by a medical student in bleeding a friend*; *Case of a tailor of the* 40*th regiment after the siege of Badajos; Effects of division of a large artery to one-third or one-fourth of its circumference; Case of a wound of the carotid by an arrow; Mr. Chamberlaine's case; Case in St. George's Hospital of stab in the thigh; Effect of a transverse opening in an artery—in man, in horses, and dogs; Complete division of an artery; Insufficiency of experiments in ascertaining the processes by which hemorrhage is suppressed; Effects of complete division on arteries of small dimensions; Case of soldier whose arm was shot off at Ciudad Rodrigo; Case of soldier whose leg was carried away at Salamanca by a cannon-shot; Contraction of extremity of the wounded artery; Effect of pressure on surrounding parts on wounded arteries; Division of arteries in amputation at the hip-joint; Division of femoral high up in the thigh; Case of thigh torn off by a cannon-ball; Probable result to the artery in such a case; Case at Salamanca; Processes in a somewhat smaller artery; Hemorrhage from lower end of divided artery; Processes of nature for closing the lower end of a divided artery; Effect of the collateral circulation; Appearances in lower end of artery; Case of a serjeant of the* 62*nd regiment at Toulouse; Case of a soldier of the German heavy cavalry; Conclusions to be drawn from these facts.*

Gentlemen,—In commencing our inquiries into the subject of wounds and injuries of arteries, and the treatment and operations required for their cure, I shall detain you for a moment on that of their structure. In Great Britain anatomists usually consider them as composed of three coats:—1. A strong, fibrous, interwoven, dense, unyielding, external tunic, firmer within than without, and of a greyish-white colour. It may be destroyed by pressure, but does not tear or separate under the application of a silken ligature; it is especially elastic and retractile. 2. A fibrous, contractile, or pseudo-muscular layer, of a yellowish-red colour—more developed in the smaller arteries—less coloured in the larger; its fibres are nearly circular, and united by others said to be oblique, or spiral; they are elastic to a certain extent, and eminently retractile and contractile. 3. A serous coat composed in the aorta of several layers. In the extremities it is a smooth and polished membrane, of a whitish-yellow colour, without fibres, soft and unctuous to the touch, of a dense, although partly transparent, structure, and readily torn in every direction by a slight degree of extension. These two last coats yield to, and are readily divided by a ligature applied to the artery with a moderate degree of force.

Baron Haller, and several of the later French anatomists, particularly Malgaigne, reckon the cellular substance which may be perceived in the aorta, but not in the pulmonary artery, between the middle and internal coats, as a fourth coat. They consider this part to be the principal seat of disease in arteries, and that to it the artery owes much of its elasticity. The structure of the external and the middle coats of an artery appears to be less dense in the female and in children than in the male, and although there is so general a resemblance between the arteries of man and of animals, as to render them apparently similar, their structure is not exactly alike. A second cellular coat, for instance, is found between the external and middle tunics in the ox. It has not been practicable to cause an aneurism in dogs, and the apparent similarity of these vessels, with reference to the effects which may result from injury or disease, cannot be depended upon; nor can any confidence be granted to the numerous experiments which have been very cruelly made on animals with the view of elucidating the various processes which occur in man.

No reliance can be placed on the efforts of nature in healing a wound in an artery in man, although it does occasionally occur. They are not to be even expected after a secondary hemorrhage, which is very rarely effectively suppressed without the assistance of art.

A *small puncture*, made with a needle, will sometimes heal, as it generally does in dogs. I have, however, seen several instances in which the femoral artery was wounded by a tenaculum during amputation, and a secondary hemorrhage followed after ulceration, requiring the application of a ligature. A *larger puncture*, or a longitudinal slit of from one to two lines in extent, does not commonly unite, except under pressure, although the edges of the wound may not always separate, so as to allow blood to issue in any quantity. It sometimes only oozes out, and occasionally does not do even that, unless some obstacle to the circulation takes place below, when blood is propelled with a jet; and the edges of the cut having once been separated, blood continues to be thrown forth in considerable quantity. When the bleeding is suppressed by pressure made on the artery above, and all causes of obstruction are removed from below, the edges of the little wound approximate, and the circulation through the wounded artery may be, and often is carried on for several hours without further hemorrhage, when it may again recur without any obvious cause. In an artery of the size of the temporal a longitudinal slit may sometimes heal without the canal of the artery being obliterated, although this very rarely takes place in one of a large calibre.

In all cases of punctured wounds of small arteries, and particularly when the bleeding has ceased by artificial means, and pressure can be effectively made, and especially against a bone, it should be tried in a graduated manner over the part injured, in the course of the artery above and below the wound, and over the whole limb generally, the motions of which should be effectually prevented, and absolute rest of the whole body enjoined, if the artery is of any importance. This should be continued for two, three, or more weeks, according to the nature of the injury, and for some time after every appearance of recovery has taken place, in order to aid in the consolidation of the parts filling up the opening in the artery.

Case 1.—A medical student, being desirous of bleeding his friend in the arm, opened the ulnar artery which in this case was very superficial. On discovering the error he had committed, he closed the wound in the skin, and applied a firm compress and bandage, under which it healed, and the edges of the cut artery seemed to be in apposition, as little blood had escaped between them. On applying the ear to the part, it sounded like an aneurism, although there was scarcely any tumour, the thrilling sound being apparently occasioned by friction against the cut edges of the inside of the artery. This thrilling noise gradually diminished, and was lost as the artery became impervious. The vessel immediately below the wound gradually recovered its pulsation, except at the exact situation of the injury, where none could be distinguished. I have seen the same thing occur in wounds of both the arteries near the wrist, from punctures of a similar size, and I have reason to infer that it has taken place both in the axillary and the femoral arteries.

Case 2.—The master tailor of the 40th regiment, tempted by the approaching prospect of plunder, was induced, on the night of the assault on Badajos, to give up the shears, and arm himself with the halbert, and was properly rewarded for his temerity by a wound from a pike in the right arm, from which, he says, he bled like a pig, and became very faint. On his arrival at the spot indicated for surgical assistance he fainted, but this was attributed to the unwarlike propensities of the man, rather than to any sufficient cause. The wound was not more than one-third of an inch long, a little below the edge of the pectoralis major, and immediately over the artery. The arm and hand were numb and cold; the pulse was not distinguishable at the wrist, and it appeared to cease at the place of injury, which was harder and a little more swelled than natural. He said that his pulse had always been felt by the doctors in the usual place. I took him into my house to watch the case, and the wound healed without any trouble, attention being had to keeping the arm warm by covering. On the 1st of May the pulsation of the artery could be felt a little below the wound, and on the 6th it was distinguishable along the lower edge of the biceps. On any exertion he had a good deal of unpleasant numbness in the thumb and forefingers. A small cicatrix formed at the place of the wound, which was otherwise quite natural to the touch. The median nerve may have been injured; that the artery was wounded there can be no doubt, and that it healed without the least assistance from art, although it became impervious at the part injured. This case proves that when a large artery is wounded in man by a sharp cutting instrument, to a certain but moderate extent, the process of cure takes place through inflammation, and by the obliteration of that part of the canal of the vessel. Continental surgeons, and especially the French, have sacrificed whole hecatombs of animals to prove this fact, which had been so many years before recorded in England, as having occurred in man.

It has not been satisfactorily proved in man that a large artery, such as the femoral, has been opened to the extent of one-third or a fourth of its circumference, and that the wound has healed without the canal becoming impervious. Two such cases are stated to have occurred in the 23rd vol. of the *American Journal of Medical Sciences;* but as the pulsation distinguished in the lower part of the vessel was not perceptible in the first instance, and was only felt after a little time had elapsed, I am disposed to apprehend that dissection would show an obliteration of the canal in each, at the point injured, although it might not be for more than the eighth of an inch in extent. A *small wound* of a large artery may close without obstructing the canal of the vessel, but the part is not so firm or solid as before, and may yield, and give rise to an aneurism, having apparently the characters of a small true, as opposed to the spurious diffused or even circumscribed swelling, which more usually follows a similar accident.

Case 3.—Colonel F. was wounded by an arrow in the right side of the neck, opposite the bifurcation of the carotid, which caused a considerable loss of blood at the moment. The wound healed, leaving only a mark where the point of the arrow had entered. Some time afterwards he observed a small swelling at the part which, from its pulsation, was declared to be an aneurism. He therefore showed it to Sir A. Cooper, who advised his doing nothing, as it did not increase. Uneasy about it, he asked my opinion at Badajos after the siege. It had not increased, but it caused him some anxiety, and I promised to place a ligature on the common carotid as soon as the campaign was over if it should increase in size. It did not do so, and nothing was done, as he was unfortunately killed in action the year afterwards.

In cases of this kind, and in that of Mr. Chamberlaine's, of Jamaica, in which he tied the axillary artery for an aneurism after a punctured wound to be noticed hereafter, the disease in the vessel seemed to be confined to the part wounded, and to be in reality a true aneurism, from the inner coats not having united firmly, and from the outer coat although united or healed having lost its elasticity, and become dilated—an effect which will, in all probability, follow an injury of an artery, when the obliteration of the canal does not take place. The wound in the artery may communicate with a vein.

Case 4.—Mr. Keate and Mr. C. Johnson have under their care in St. George's Hospital at present, a young man who received an injury from a knife, on the 28th of October, 1845, as nearly as possible in the inside of the middle of the right thigh, which bled profusely, until he fainted. The wound was then closed, and secured by compress and bandage for between two and three weeks, when on their removal it was found to be healed, but a small pulsating tumour had formed, for which he was sent to the hospital. This was manifestly an aneurism, but from the peculiar thrill it communicated to the touch, and which could be distinguished even above Poupart's ligament in the femoral and iliac veins, it is believed to be a *varicose aneurism*, which is said to be formed when the artery and vein have been both opened, having some cellular membrane as a means of communication between them, and through which the blood is propelled from the artery into the vein. When the blood is propelled directly into the vein so as to enlarge it, the complaint is called an *aneurismal varix*. The man being in bad health all operative methods were considered improper, and under a light but well regulated pressure on the part, the tumour is diminishing in size, is firmer to the touch, the thrill and sound are certainly less marked, and a cure may be effected, although in these cases it rarely occurs without a ligature being placed above and below the opening in the artery.

When an artery in man is cut *transversely*, or to a fourth of its circumference, it forms a circular opening as in animals, and if the artery be large the bleeding usually continues until the person faints, or it is arrested by pressure. The difference between arteries in man and in animals is here strongly exemplified. In dogs the bleeding commonly ceases without any assistance from art, and without the animal being exhausted; in horses and sheep they usually bleed until they die; whilst in man, even with the best aid from compression, hemorrhage will in all probability recur, unless the circulation be altogether stopped. If the external opening only should be closed, a spurious, circumscribed aneurism will be the consequence in so small an artery as the temporal, and I have often been obliged to lay open, and sometimes to apply a ligature above and below a little aneurism of this description. When it has been of a smaller size I have merely divided it transversely, and applied pressure; but there is some danger of the pressure becoming deranged, and of a return of the hemorrhage. In a larger artery the spurious aneurism may or may not be diffused.

When an artery is *completely divided*, it is less likely to continue to bleed than if it had been only wounded, and a variety of opinions have been entertained as to the means employed by nature, as well as by art, for the suppression of the hemorrhage.

In my work on the Diseases and Injuries of Arteries I have quoted the opinions of the most esteemed authorities—on the means employed by nature for the suppression of hemorrhage—from Celsus, Rufus, Galen, and Œtius down to Dr. Jones, the latest and most important of all. The methods they generally adopted appear to me to have been insufficient for and unequal to the object in view. They bled an animal until he died, and then reasoned on the manner or means by which the bleeding was suppressed, when it was in fact arrested by death. It is only when nature has not been interfered with, and the patient has not died from bleeding continued to the last moment, but has on the contrary lived some time after the hemorrhage has ceased, that the processes by which its suppression has been accomplished can be fairly investigated. These processes essentially depend on the size and variations of structure in an artery. They are dissimilar in large and small arteries, and not even quite alike in the upper and lower ends of the same artery—facts which were elicited from observations made on man on the field of battle during the Peninsular war, and consequently not liable to error.

Arteries of moderate dimensions, such as the femoral or axillary, tibial or brachial, and particularly all below these in size, are capable by their own intrinsic powers when completely divided, of arresting the passage of the blood through them without any assistance from art, or from the surrounding parts in which they are situated. This fact overthrows at once the whole theory which relates to the importance of and necessity for the sheath of the vessel, and the offices it performs in suppressing hemorrhage; and in a great measure, to that supposed to be derived from the formation of an external coagulum, the *bouchon* of the French.

Case 5.—A soldier who had his arm carried away by the bursting of a shell at the siege of Ciudad Rodrigo, was brought to me shortly afterwards. The axillary artery becoming brachial, was torn across, and hung down lower than the other divided parts, pulsating to its very extremity. Pressed and squeezed in every way between my fingers in order to make it bleed, it still resisted every attempt, although apparently by the narrowest possible barrier, which appeared to be at the end of the artery, and formed by its contraction. The orifice of the canal was marked by a small red point, to which a very slight and thin layer of coagulum adhered, the removal of which had no influence on the resistance offered by the very extremity of the artery to the passage of blood through it. In this, and in another instance of a similar nature, I cut off the end of the artery at less than an eighth of an inch from the extremity, when it bled with its usual vigour. In both, the vessel for near that distance was contracted so as to leave little or no canal at its orifice, which in these cases was filled by a coagulum of the size and shape of a very small pin.

Case 6.—During the battle of Salamanca a soldier was brought to me whose leg had been carried away by a cannon-shot. I found the posterior tibial artery pulsating to its extremity in a similar manner. As he had lost a considerable quantity of blood, and was much discouraged, I did not try to make it bleed, but amputated the leg forthwith, and examined the artery afterwards. I have had many opportunities of seeing the same thing, and therefore assert that it is in the very extremity of the cut artery that the power or means of suppressing hemorrhage resides after the vessel has been divided. In many cases of amputation, in which I wished the patient to lose a certain quantity of blood, I have allowed an artery to bleed until it ceased. The jet in such cases appears to be propelled at first irregularly, or by jerks, the stream then becomes continuous, although acquiring a little impulse from each contraction of the heart. As the orifice contracts, the flow of blood becomes more equal, it is thrown to a less distance, the size of the stream is smaller, and it goes on diminishing until at last the blood only oozes out, and by the time it ceases altogether to be discharged, the extremity of the vessel is covered by a thin layer of coagulum, which is readily removed from it. In many cases in which I have examined the parts after death or after amputation, in consequence of disease below the injury of the artery, this contraction of the vessel was evident, as well as the formation of the very thin layer of external coagulum, extending like a fine red thread into the canal of the artery. The sheath of the artery could, in the cases related, do nothing, because it was carried away—it was not present—neither did the internal coagulum, on which so much stress has been laid, because at this period, strictly speaking, it does not exist.

In small vessels, such as the radial or ulnar arteries, little depends on the diminished power of the circulation; but when the axillary or femoral artery is divided, the shock of the injury and the loss of blood, powerfully contribute in the first instance to the suppression of hemorrhage, by subduing if not momentarily arresting the action of the heart. Having thus established the fact by observation and experiment on man, that arteries in the extremities of the second order in regard to size, will cease to bleed through their own efforts, unaided by the assistance of the surrounding parts, I am far from intending to imply that no assistance is ever given by the surrounding parts when the femoral artery is cut across high up. When an artery of this size is divided in situ, and retraction has taken place, the wound in the limb being small and not direct, the assistance is oftentimes considerable, although it is only auxiliary by retaining the coagulated blood in its place against the ragged orifice of the contracting vessel. If the axillary artery be laid bare previously to an operation for amputation at the shoulder, and the surgeon take it between his finger and thumb, he will find that the slightest possible pressure will be sufficient to stop the current of blood through it. Retaining the same degree of pressure on the vessel, he may cut it across below his finger and thumb, and not one drop of blood will flow. If the artery is fairly divided by the last incision which separates the arm from the body, without any pressure being made upon it, it will propel its blood with a force which is more apparent than real. All that is required to suppress this usually alarming gush of blood, is to place the end of the forefinger directly against the orifice of the artery, and with the least possible degree of pressure consistent with keeping it steadily in one position, the hemorrhage will be suppressed. It is more important to know, that if the orifice of the artery from a natural curve in the vessel, or from other accidental causes, happens at the same time to retract and to turn its open orifice a little to one side, so as to place it in close contact with the side or end of a muscle, the very support of contact will sometimes be sufficiently auxiliary to prevent its bleeding.

In amputation of the hip-joint, the femoral, and profunda arteries are usually divided at, or just below the origin of the latter, and bleed furiously if disregarded; but the slightest compression between the finger and thumb stops both at once. They never have given me the smallest concern in these operations, or others of a similar nature, and I have learned to hold all arteries that can be taken between the finger and thumb in great contempt. It is quite impossible for a man to be a good surgeon—to do his patient justice in great and difficult operations attended by hemorrhage unless he has this feeling—unless his mind is fully satisfied of the truth of these observations. Whilst his attention ought to be directed to other important circumstances, it is perhaps absorbed by the dread of bleeding, by the idle fear that he will not be able to compress the artery and restrain the bleeding from it—that he may have half a dozen vessels bleeding at once—that his patient will die on the table before him. Once fairly in dismay, and the patient is really in danger; but, endowed with that confidence which is only to be acquired through precept supported by experience, he surveys this scene with perfect calmness; taking the great artery between the finger and thumb of one hand, he places the points of all the other fingers of both if necessary, on the next largest vessels; or he presses the flaps or sides of the wound together until his other hand can be set at liberty by an assistant, or in consequence of a ligature having been passed around the principal artery. I admit that this is a scene sufficient to try the presence of mind of any man; but he is not a good surgeon who is not equal to it—who does not delight in the recollection of it when his patient is in safety, and his recovery assured. I have seen many persons die on the table under great operations. I never lost one from hemorrhage, except in one instance in which a tourniquet was applied. It was with no small satisfaction I heard a gentleman some six months ago, publicly state in the board-room of the Westminster Hospital, that the surgeons of another hospital to which he was especially attached, never used a tourniquet in amputation, and declare it to be an indication of their superiority over those who did resort to it for assistance. Joining most cordially in the approbation thus bestowed, I could not but feel gratified in recollecting that I was the first who publicly taught this method of proceeding; and it must be highly satisfactory to those governors who take an interest in the character of the Westminster Hospital to know that it was under their auspices and in their hospital it was first practised in London. It was in consequence of this recommendation that my old friend, Sir Charles Bell, whose loss to science cannot be too much regretted, represented me seated on a pack-saddle on the back of a bourro (*Anglice,* a jack-ass), on the top of the Pyrenees, expatiating on the merits of these barbarous proceedings to the descendants of the Bearnois of Henri Quatre with one hand, and to the children of the lieges of Ferdinand and Isabella with the other.

When the femoral artery is *cut across* in the upper part of the thigh, whether it be done by a cannon shot, a musket ball, or a knife, the patient does not always bleed to death at once, although he frequently dies after a time in consequence of the shock and the loss of blood. He is less likely to die if the artery is divided in the middle or lower half of the thigh, but in both cases it is probable the hemorrhage will cease of itself. If it should recur, it will be more likely to take place from the lower than the upper part of the artery, on account of the different process adapted by nature in these cases—facts, the knowledge of which we also owe to the war in the Peninsula.

Case 7.—At the battle of Toulouse, a large shot struck an officer and two men immediately behind him, and nearly tore off the right thigh of each. The artery was divided about, or less than three inches below Poupart's ligament. I saw him shortly afterwards in consequence of his surgeon saying it was a case for amputation of the hip-joint. The pulse was feeble, the countenance ghastly, bedewed with a cold sweat, and with every indication of approaching dissolution. The house being at an advanced point, and close to one of the French batteries, the fire of round shot and musketry was so severe upon and around it, as to induce me to remain until the battery should be taken by the troops then advancing upon our flank. In order to occupy my time usefully, I returned to the officer, and found he had just expired. Desirous of seeing by what means the hemorrhage had been arrested, I cut down upon the artery, took it carefully out, and found that its divided end was irregularly torn; a slight contraction had taken place just above, but not sufficient to have been of the slightest utility in suppressing the bleeding, which was in fact prevented by an external coagulum which filled up the ragged extremity of the vessel, and which in a few days would have been removed with the purulent discharge. The orifice of the artery, and the surrounding surface for at least an inch in extent would then be covered by a yellowish green-coloured matter, very distinct in appearance from the natural structure, and so strongly marked as to point out the situation of the extremity of the artery.

Case 8.—At Salamanca I had the opportunity of examining the thigh of a French soldier, whose femoral artery had been divided perhaps even higher up by a cannon shot. He lived until the next morning when I saw him, no operation whatever having been attempted, nor a tourniquet applied. He died exhausted, but not from any immediate bleeding, which when once stopped had not returned. The artery was in a similar state to the preceding one, with this slight difference, that the orifice was a little more contracted, the external coagulum filled up the ragged end of the artery, and was slightly compressed within by the contraction which kept it in its place. The rest of the coagulum filled the hollow in the surrounding parts which the retraction of the artery had occasiond. In this case, so unlike those I have hitherto noticed, the first natural cause giving rise to the suppression of the bleeding was the diminution of the power of the heart; the second the formation of a coagulum in the hollow of the sheath left by the retraction of the artery. Contraction had begun, but had done nothing essential.

If a case of this kind should survive, and the hemorrhage should be ultimately restrained by natural causes, I am led to surmise from what I have seen in the artery a little lower down, that the continued contraction which occurs in a circular direction just within the rugged or torn end would gradually lead to the protrusion of the external coagulum, projecting into its canal, like a mammillary process—an operation which would be assisted by the lymph or fibrin poured out from within and around the artery.

In other instances in which I have examined the extremities of such large arteries when divided, the appearances have been more or less of a similar nature; unless where the persons had died immediately, when the torn extremities were found quite open and with little surrounding coagulum.

The processes of nature are different in an artery of a somewhat smaller calibre. When the femoral artery has been fairly divided in the middle or lower part of the thigh, the patient has, in almost all the cases which have come under my observation, either died without assistance, or the hemorrhage has ceased spontaneously. Having been arrested for twelve hours, the efforts of nature are usually sufficient to prevent its return from the upper, although not from the lower end of the vessel; but then it is of venous and not of arterial colour—a fact now acknowledged to be of the greatest importance. The great evil to be dreaded in such cases, is not from hemorrhage from the upper end of the divided artery, but from the lower, and from mortification of the foot, which circumstance I shall notice in its proper place.

The upper end of an artery retracts on being divided, and this retraction is accompanied by a contraction of the cut extremity of the vessel, which assumes the shape of the neck of a French wine-bottle or Florence oil-flask. The contraction is confined in the first instance to its very extremity, so that the barrier opposing the flow of blood is formed by this part alone. The contraction goes on, however, increasing for the space of an inch, which is usually filled up with an internal coagulum, of a round pyramidal shape, adhering firmly to the contracted end of the artery, loose at its apex, and extending frequently as far as the first collateral branch, but rarely under any circumstances beyond two inches; the very orifice of the artery on the outside being in a few days covered by the yellowish green-coloured matter I have already alluded to. Some of these processes are continued even after the external wound has healed; the artery goes on diminishing and contracting as far as it is useless, so that of four or five inches, from one to two may be impervious, the remainder being contracted although still permeable by a probe. An accompanying nerve where there is one would do the reverse, the cut extremity would be enlarged or bulbous, gradually diminishing as it is traced upwards, until it becomes of its proper size.

The processes adopted by nature for closing the end of the lower extremity of an artery of the size of the femoral at the inferior part of the thigh, are different from those employed at the upper or opposite extremity. The retraction or contraction of the lower end of a divided artery is neither so perfect nor so permanent as at its upper end, and the small internal coagulum is in many instances altogether wanting or very defective in its formation. The closure of the lower orifice being less perfectly accomplished than the upper, it is the most likely to suffer from secondary hemorrhage, which may be distinguished from that from the upper end of the artery at an early period after the accident, by the venous colour of the blood, and from its flowing or welling out in a continuous stream, as water rises from a spring, and not with an arterial impulse.

The retracting and contracting powers in the lower end of a divided artery are, nevertheless, considerable, and are sufficient in some cases to nearly close the lower end of the femoral artery when divided by amputation above the knee. When the femoral artery is cut across, the lower portion of the vessel is emptied by its last efforts, combined with the action of the capillaries. When the collateral circulation is powerful, blood soon regurgitates into the artery, but the force of the regurgitation can be in no proportion to that of the propulsion at the other or upper divided end of the vessel, which will generally be able to resist this impulse; whilst the lower one often opens and bleeds after the lapse of a few days. In all the cases I have had an opportunity of examining, in which hemorrhage had taken place from the lower end of the artery, the following appearances were observable after the interval of four to five days:—

The same kind of yellowish-green matter marks and conceals the situation of the lower extremity of the artery as it does the upper. It is however thinner where it immediately covers the end of the artery, which in none of these cases is contracted in the conical manner described as taking place in the upper extremity. On the introduction of a probe with the greatest gentleness into the artery from below, it usually makes its appearance at a point on the yellow space, raising a thin portion as it protrudes. On laying open the artery, the orifice would seem to have been once closed by this layer of fibrin, but with a less degree of contraction than the upper end of the same artery; the layer still however forming an obstacle sufficient to cover and close three-fourths of the orifice, the blood having flowed through the remaining fourth, which had probably given way by accident. The following case is illustrative of the several points alluded to.

Case 9.—Serjeant William Lillie, of the 62nd regiment, aged thirty-two, was wounded in the right thigh, on the 10th of April, at the battle of Toulouse, by a musket-ball, which passed through, in an oblique direction downwards and inwards, close to the bone, describing a track of seven inches. The ball was extracted behind on the field. He said he had bled a good deal on the receipt of the injury, which he had stopped by binding his sash around the limb. The discharge from the wound was considerable; it appeared, however, to be going on well until the 20th of the month, when, on making a sudden turn in bed, dark coloured blood flowed from both orifices of the wound in considerable quantity. I had given an order as chief of the medical staff in Toulouse, that no operation should be performed on a wounded artery without a report being sent to me, and an hour at least granted for a reply, unless the case were of too urgent a nature to admit of it. It appeared to be so in this instance, and before I arrived Mr. Dease had performed the operation for aneurism at the lower part of the upper third of the thigh. I could only express my regret that it had been done, and point out the probability of the recurrence of the hemorrhage from the lower end of the artery, which took place on the 7th of May, when the limb was amputated, and the man died. On examination the artery was found to have been divided exactly where it passes between the tendinous expansion of the triceps and the bone. The upper portion of the artery thus cut across was closed. A probe introduced into it from above would not come out at the face of the wound, although the impulse given to this part on moving it was observable in the middle of a large yellowish-green spot, which I had previously declared to be the situation of the extremity of the artery, which had contracted behind this, in the shape of a claret-bottle for about an inch, having within it a small coagulum. The lower end of the artery from which the hemorrhage had taken place was marked by a spot of a similar character ; but on passing a probe upwards from the popliteal space, it came out at a very small hole in the extremity of the artery, in the centre of the yellow spot, the canal of the artery not being contracted and diminished, but only apparently closed by a layer of the yellowish-green matter laid over it, and adhering to its circumference.

Case 10.—A soldier of the German heavy cavalry was wounded nearly in a similar manner at the battle of Salamanca, and died in the night, some days after the injury, from inattention. The appearances were nearly the same, and I have had so many opportunities of verifying these points, that I do not hesitate in considering the following as three important facts, first demonstrated and proved during the war in Portugal, Spain, and France, and that nothing has since occurred to impeach their accuracy.

1. That an artery as large as the femoral is capable, when divided, of taking on certain processes, which will cause a suppression of hemorrhage from its upper end, and which suppression is usually permanent.

2. That the bleeding from the lower end of the same vessel is less certainly and less permanently restrained, and not by exactly similar processes; the blood issuing from the lower end of the femoral artery being for the first few days of a venous colour. It is less so from the axillary artery, in consequence of the collateral circulation in the upper being more free than in the lower extremity, and the change of colour is sometimes not perceptible in the smaller arteries of the forearm, although it is generally so in those of the leg.

3. That this bleeding from the lower end of the vessel, which is more or less of a venous colour, and issues in a continuous stream, may be restrained by compression properly made on, and in the course of the lower part of the wounded artery ; but that in no instance should recourse be had to a ligature on a distant part of the artery above the seat of injury, until every other possible effort to arrest the hemorrhage has failed.

# LECTURE II.

*Partial division of arteries; Case of partial section of the brachial artery; Case of slit in the femoral artery; Wound of a deep-seated artery the cause of extravasation of blood in the cellular structure of the limb, forming a non-pulsating tumour in general; Pulsations of some tumours caused by the impulse given to them as a mass by the artery against which they are lying; The whizzing sound or thrill absent in such cases; The extravasated blood, if it remain fluid, causes suppuration, if coagulated, is absorbed; If it increase in quantity, the wounded artery should be cut down upon, and tied. The external wound in these cases the guide for the incisions in cutting down upon the artery; Distinction between a false aneurism from a wound and from disease; Operation for a false aneurism from a wound; Mr. Keate's case; M. Delpech's case; Professor Petrunti's case; The false aneurism should be laid open as soon as its nature is ascertained; Injury of an artery by external violence; Case of aneurism in the lower part of the thigh from a blow; Inflammation and abscess following an injury to an artery; Diffused aneurism from the same cause; Enlargement of the collateral circulation after ligature of an artery. Two distinct kinds of collateral circulation; Mortification of a limb the result of a sudden injury to an artery, the collateral branches not having time to enlarge; The external iliac ought not to be tied for diffused aneurism in the groin from punctured wound of the femoral artery; Will cause mortification of the limb, or peritoneal inflammation, with the formation of matter behind it, on secondary hemorrhage from the unclosed ends of the artery, or suppuration of the sac; Ligature of the subclavian inapplicable for a wound of the axillary artery; The Hunterian theory of the cure of aneurism totally and utterly inapplicable to the treatment of wounded arteries accompanied by an open wound; A wounded artery should be secured at the part where it is injured; Case of aneurism in the ham, with an increased number of the collateral branches; Case of wound of the femoral artery by a musket ball; Occurrence of mortification, requiring amputation; Condition of the wounded artery; Case of musket-shot wound of the femoral artery; Fatal mortification; Case of musket-shot wound of the femoral artery and vein; Secondary hemorrhage; Ligature of the wounded vessels; Fatal mortification; Wound of the popliteal artery; Mortification, amputation, death; Wound of femoral artery; Occurrence of mortification ending fatally, from the non-performance of amputation; Wound of the femoral artery; Partial mortification; Occurrence of secondary hemorrhage; Ligature of a large branch of the femoral by mistake; Death; Wound of a branch from the profunda; Improper ligature of the femoral, terminating fatally. Cases of mortification from injury of the popliteal ending fatally while waiting for the line of demarcation; Fatal mortification from arteritis; Case of diffused aneurism from injury of the popliteal, threatening gangrene; Treatment by incisions; Case of ligature of the common iliac for supposed gluteal aneurism; Prevention of mortification by frictions on the limb for twenty-four hours; Conclusions.*

When an artery is merely cut or torn half through, but not completely divided in the first instance, it is in the same state with regard to hemorrhage, as if it had partially given way by ulceration. It can neither retract nor contract, and will continue to bleed until it destroys the patient unless pressure be accurately applied, and maintained until further assistance can be procured. The practice to be pursued is to divide the vessel if it be a small one, such as the temporal artery, when it will be enabled to retract and contract; and the bleeding will in general permanently cease under pressure, especially when it can be applied against the bone. If the artery is of a larger class, and continues to bleed, it should be sufficiently exposed by enlarging the wound; a ligature should be applied above and below the opening in the vessel, which may or may not be divided between them at the pleasure of the surgeon.

Case 11.—During the battle of Talavera, in 1809, a man was brought to me who had lost a large quantity of blood from a wound made by a musket ball in the arm, which had bled profusely, and was only arrested by tying a handkerchief tight over the wound. The brachial artery, just below the edge of the pectoral muscle, had been half cut across, and on being exposed again, bled furiously. A ligature was placed on the artery, above and below the wound, and the man perfectly recovered.

Case 12.—In June, 1829, I happened to be at Windsor, on a visit to my old friend the late Dr. Fergusson, and was called to a young gentleman, the upper part of whose right femoral artery had been accidentally cut by the point of a scythe. On dilating the wound, a tourniquet being on the limb, black blood flowed freely from it; on unscrewing the tourniquet by degrees, arterial blood showed itself, and the upper end of the artery was secured by ligature when the tourniquet was removed. Venous-looking or black blood then again flowed in greater abundance than before, and evidently from a large vessel. This I restrained by pressure made below the wound with the thumb of the left hand, whilst I laid bare the lower part of the artery, from a slit in which near an inch in length, the black blood was seen to flow. A ligature passed around the vessel below the wound, suppressed the bleeding. The artery was not divided, and the young gentleman perfectly recovered, and has continued well until this day. The absolute necessity for two ligatures was here well shown, as well as the flow of dark coloured blood from the lower end of the artery.

When an artery is wounded at some depth from the surface, and the external opening is small, blood not only issues through the opening, but is often forced into the cellular structure of the limb to a considerable distance, the pulsation of the tumour is observable, and the thrill or sound which accompanies a ruptured artery is distinct. If a large quantity partly in a fluid, partly in a coagulated state, is collected immediately over and around the wound in the artery, the tumour may not pulsate or give forth any sound if the coagulated blood is in considerable quantity, although some elevation of the tumour may be observed corresponding to the pulse.

This rising or pulsation of the swelling often depends on the impulse given to the whole as a mass by the artery against which it is lying, and not upon blood circulating through it. An impulse of this kind is distinguishable in a bronchocele, which lies immediately over and in contact with the carotid artery, and was well shown in two cases which came to me from the country for operation, being supposed to be aneurisms. The mere act of deglutition removed the tumors from the artery, and showed they belonged to the trachea, and not to the vessel, and when elevated, the pulsation was nearly indistinct. It is the same when blood is extravasated by the rupture of small vessels, in consequence of the passage of a wheel over the limb, and especially in the thigh, where I have seen a swelling containing fluid blood pulsate in an almost alarming manner, until it gradually diminished as the blood coagulated, when the motion became a mere elevation at each stroke of the heart. The whizzing sound or thrill attendant on a ruptured artery is in these cases wanting, being a very diagnostic mark of this accident, although I am well aware that where there is true aneurism, and it has burst, forming a diffused and spurious one, the thrill may be wanting, but the history of these cases enables a surgeon to distinguish between them. If several ounces of blood are thrown out, and remain fluid, they ought to be evacuated, or suppuration will ensue. If they become coagulated, the mass will be gradually absorbed. Fluid blood should be evacuated by a small opening, and the part afterwards treated by compress and bandage. If the fluid or partly coagulated blood should increase in quantity, and the swelling continue to enlarge and pulsate, the extension of the mischief should be arrested by opening the swelling and securing the artery by ligature.

When the external opening is enlarged, and the clots which filled it up are at all disturbed, arterial blood begins to flow, and the finger will readily follow the track through which it passes down to the artery, if it should not be too far distant. If the incision is made sufficiently large to enable the operator to remove these clots of blood with rapidity, the finger will more readily pass down to the wound in the artery, which, if a large one, may be thus easily discovered, if within reach and sight, provided the tourniquet be thoroughly unscrewed, and the surgeon is not afraid. A ligature should then be placed above and below the opening in the artery. M. J. Z. Amussat, in a memoir read before the Royal Academy of Sciences, of Paris, in February, 1843, has dwelt at length on, and has attached perhaps more importance to this track leading from the external opening to the wound in the artery, than it appears to deserve. The great merit of his work is, however, the acknowledgment which he thinks it a matter of great importance to make, and which he supposes he has deduced from his own observations, "that the surgeon should take the wound for his guide in all these cases of aneurismal swelling, and follow the conducting canal in the tumour itself down to the wound in the artery, which is to be secured by ligature above and below the opening in it, unless the external wound should be too distant from the course of the vessel." This is a fact worthy of remark, being an acknowledgment of the correctness of those opinions, and of that practice I have promulgated by my writings and lectures since the battle of Albuhera, in 1811.

When an artery is wounded, and the external opening in the integuments heals so as to prevent the blood from issuing through it, a traumatic, spurious, circumscribed, or diffused aneurism is said to form, according to the facility which is offered by the structure of the parts for the confinement or diffusion of the extravasated blood. A traumatic aneurismal tumour of this nature differs essentially from aneurism which has taken place as a consequence of disease, and not of direct injury. If a spurious aneurism forms from disease, the artery is in general unsound for some distance above and below the tumour. In the aneurismal tumour from a wound, the artery is perfectly sound, except as far as concerns the seat of injury. There is then not only a great and essential difference between these two kinds of aneurism as regards their nature, but also with respect to the collateral circulation, and the operation to be performed for their cure; and the surgeon may not overlook these facts.

Case 13.—A school-boy, about fourteen years of age, let a penknife drop from his hand while sitting down, and drew his knees suddenly towards each other to catch the falling knife; the point was thus forced into the inner and middle part of the thigh, and wounded the femoral artery. The medical man on the spot put a plaster on the little incision in the integuments, and the wound quickly healed. The boy complained of uneasiness, but was supposed to be making more of it than necessary, and was made to go into school as usual. The limb however began to swell, and the boy was brought to London, and consulted his family surgeon, who put him to bed, and poulticed and fomented him, expecting an abscess had formed, which I was sent for to open during his illness. I found the limb very much enlarged from the upper part to the knee, and with that peculiar discoloration which convinced me that blood was under the integuments, and I refused to open it where the abscess was supposed to be pointing, until I had everything ready for the operation of securing an artery. There was no pulsation to be felt when I first saw it, and I was assured there had been none. When all was ready I introduced the point of a lancet, and after a clot of blood had been forced out, a jet of arterial blood flew across the room. The hemorrhage was arrested by pressure below Poupart's ligament, whilst I enlarged the opening in the integuments. Two washhand-basins were filled with coagula, and I put my finger on a large opening in the artery, under which two ligatures were passed by means of an eye-probe, and the artery was divided between them. The muscles had been cleanly *dissected*, and the cavity extended from the fork internally, and trochanter externally, to the knee. There was much less suppuration than I expected. The ligatures were detached about the usual time, and the patient entirely recovered. This case was given to me by Mr. Keate, and the following is from *Delpech Clin. Chir.*

Case 14.—M. Maigret was wounded by a small triangular sword in October, 1816, in the lower part of the left thigh; the anterior wound bled profusely, but the bleeding was arrested by compression, and at the end of eight days both the external wounds had healed. On moving about incautiously he felt pain in the part, and perceived a small tumour under the cicatrix in front, about the size of a nut, and which rapidly increased, so that on the fifteenth day the femoral artery in this case, accompanied by *two* veins, was tied above the edge of the sartorius muscle, by an incision begun three inches below Poupart's ligament. The patient perfectly recovered, although it was a long time before the swelling totally disappeared.

Case 15.—Raffaele Castaldi, aged thirty-seven, was stabbed, July, 1824, on the external and superior part of the left thigh, and lost a considerable quantity of blood. The wound closed, and at the end of eight days a small, but strongly beating tumour was observed opposite to the cicatrix. The treatment of Valsalva was adopted, and ice and astringents were applied to the swelling. These means were continued until December, and ultimately led to the formation of a deep eschar on the face of the tumour. On the cicatrisation of the ulcer left by this, the swelling was found to be diminished, to be hard, and without pulsation. At the end of a year, believing himself cured, he placed a piece of copper over the firm swelling, by way of protection, and returned to his usual laborious exercises. In November, 1834, twelve years afterwards, on lifting a heavy weight, he felt something give way in the old swelling, which immediately became larger, and beating, and in 20 days extended from one inch below Poupart's ligament to the lower fourth of the thigh. Professor Petrunti applied a ligature immediately below Poupart's ligament, which came away on the thirteenth day. On the thirtieth, the wound was nearly healed. On the thirty-first day, bleeding took place from the wound, which was restrained by compression, but returned on several occasions. A compress and tourniquet were then fitted on above Poupart's ligament, which succeeded in stopping the hemorrhage, but gave rise to a deep gangrenous eschar, which took a long time to cure. Three months after the operation the wound healed, the tumour gradually diminished, and the patient ultimately recovered.—*Gazette Medicale*, 1835, p. 647.

Case 16.—A young man of sixteen was wounded on the inner and lower part of the thigh by a penknife, and lost a considerable quantity of blood, which was restrained by compress and bandage, and the young man was kept in bed for three weeks, when a profuse bleeding took place, which was again suppressed by his bandages. He suffered severe pain during the night, and the next day the formation of a swelling at the wounded part was evident. Three more bleedings took place, the swelling increased so as to occupy two-thirds of the inner aspect of the thigh; and exactly one month after the accident it was decided in consultation that the artery should be secured. Mr. Bell made an incision between five and six inches long, taking the *original* wound as a centre, removed all the fluid and coagulated blood, placed a ligature above and then below the wound in the artery, and closed the wound. The young man perfectly recovered, the limb two years afterwards being in no way deteriorated by the injury. This case is from the *Lancet*, vol. 1830—31.

These four cases show three different modes of treatment. Mr. Keate, called upon to open an abscess, demurred, doubtful whether he had not a diffused aneurism to deal with. M. Delpech knew he had a diffused aneurism before him, but which was not so large as to preclude his placing a ligature above it, yet below the profunda, on which, he says, he reckoned for the support of the limb. He succeeded, and his operation (of Anel) was admissible, because there was no external opening communicating with the sac, and that the blood in it was coagulated. If it had remained partly fluid, partly in clots, suppuration would in all probability have taken place, and a renewal of the bleeding might have occurred, requiring another operation. The proceeding adopted by Mr. Keate and Mr. Bell was therefore the safest and the best, even under the most favourable circumstances. In M. Petrunti's case the tumour was not absorbed, and the artery yielded after an interval of twelve years from the receipt of the injury, probably from becoming diseased. The operation of Anel failed, when that of Hunter on the external iliac would have been done by all English surgeons, and would have succeeded, inasmuch as there is reason to believe that the upper part of the femoral artery was unsound, whilst the compression above the pubis, which gave rise to the deep gangrenous eschar, obliterated the canal of the external iliac artery in a similar manner to the operation.

The great error in all these cases consisted in not laying open the tumour on the eighth or tenth day, whilst it was small, or as soon as its nature was distinctly ascertained, and placing a ligature on the artery above and below the wound. If a tumour of this kind, being circumscribed in the first instance should burst, and blood be in consequence poured out into the cellular membrane of the whole limb, it swells enormously, and gangrene is oftentimes only prevented by amputation. This may occur in a case of true aneurism, and is always a very dangerous accident. If taken in time the ordinary operation for aneurism may suffice, if long-deferred, amputation will be a last but not often a successful resource.

An artery may be injured by external violence without being punctured, and without any external wound, the consequence being the obliteration of the canal, mortification of the extremity, or the formation of an aneurism, which may be a true one by dilatation if the internal coats only are affected, or it may, through ulceration, suppuration, and sloughing, be spurious, and circumscribed, or diffused.

Case 17.—A stout, young, and healthy man was admitted into the Westminster Hospital with an aneurism of the lower part of the thigh, about the size of a small but flattened orange. Some three months before, he had received a sharp blow on this part from the edge of a piece of hard leather, which gave him acute pain for a time, and he some days afterwards discovered the beating swelling for which he was sent to me. A ligature, composed of one thread of strong dentist's silk, placed on the femoral artery in the lower part of the upper third of the thigh, came away on the twelfth day, and the man perfectly recovered. There can be little or no doubt of the aneurism having formed after a partial rupture or derangement of the inner coats, and from a dilatation of the outer coat of the artery.

Case 18.—A young and healthy man, of a vigorous constitution, was discharged from a cavalry regiment, and sent to me with an aneurism of the thigh, where the artery passes through the triceps. Some weeks previously the horse of another soldier had run against him when on horseback, and forced the end of a hard holster between the affected thigh and the saddle, giving him acute pain at the part, which subsided into an uneasiness for a day or two, some time after which he discovered a small beating swelling, which gradually enlarged, and prevented his riding, and on account of which he was discharged. I admitted him into the Westminster Hospital, placed a ligature on the femoral artery at the usual place, and he perfectly recovered.

When inflammation and abscess follow an injury inflicted on the artery through violence, without an external opening, or if sloughing should take place, the treatment by incision is absolutely necessary, as well as the application of two ligatures to the artery. When a diffused aneurism forms rapidly in a limb after a great injury, but without an external wound, the place in which the artery or arteries is or are injured being unknown, the case is greatly complicated, and requires the most serious consideration, whether the trunk of the artery shall be tied or the limb be amputated. If signs of mortification occur, the limb should be cut off forthwith.

A correct knowledge of the collateral ciculation is of the utmost importance; surgeons understand by it the means whereby blood is sent to the extreme parts of a body, or to a limb, when the usual supply through the principal trunk is cut off. This collateral circulation is more perfect, more active in young persons during the increase or growth of the body, than it is either at maturity, or in the decline of life. The important point is not, however, alone referrible to the time of life in which the continuity and permeability of the main trunk ceases to exist, but to the nature of the disease or injury which has given rise to it.

When an operation has been successfully performed for aneurism, and the patient has died, some time afterwards dissection has shown various arteries enlarged, both above and below the part where the trunk was obliterated by the ligature; and not only an enlargement of arteries, which from their regularity have received names, but others have been developed not usually known to exist, or not of a size to be conveniently traced. These through their frequent anastomoses bring the blood at last into several larger trunks, by which it is again conveyed to the original vessel below all and every obstruction which may have taken place; thus compensating by a circuitous route for the loss of the direct supply. The principal object of inquiry is, do these vessels always exist, or at what period of time do they begin to enlarge, so as to enable them to carry on the circulation, in the manner in which it is presumed to be done?—for few will assert, that the enlargement of these particular collateral vessels was an accidental play of nature, and existed previously to the commencement of the disease or injury for which the operation was performed. On this point, the theory of the operation for aneurism and its applicability to wounded arteries appears to hinge; and what is of more importance, on which the practice resulting from it depends.

Two distinct kinds of collateral circulation are at present acknowledged: one by direct large communicating arteries; the other through the indirect medium of the capillary vessels, inosculating with each other. Where the direct communicating arteries exist, little subsequent change takes place in them.

It is otherwise with the indirect capillary vessels. When the radial or ulnar artery is divided in the hand, the blood will not only flow readily from each end of the divided vessel, but equally red and arterial from both; the communication being through direct arterial branches from one vessel to the other. It will also be red and arterial if the division take place at the wrist; and may be so in the brachial, but if the femoral in the lower part of the thigh be wounded, the colour of the blood issuing from the lower end of the artery, if any issue at all, will be venous. It is so, because it has been obtained from the capillary arteries, which in this case being empty receive blood by regurgitation from the veins, the valves of which when present do not prevent its reflex course. If a limb be injected and carefully dissected four or five days after a ligature has been placed during life high up on the principal trunk, the capillary vessels will be seen to be well injected; but few or none will be found large enough to admit of their inosculation being traced throughout. If another limb be injected and dissected, some sixty days after the ligature has been applied,—and opportunities have occurred of making such dissections in man,—a difference will be distinctly observed between the two preparations. In the latter, the capillaries will not appear to be so fully injected, but several larger and more tortuous vessels will be found in situations where they were not expected to exist; and the anastomoses of these one with another, and generally by arches, may be traced to their communication with the principal trunk, both above and below the obliterated parts. If an incision were made in the nearest pervious portion of the lower part of an artery of a person who had undergone this operation, arterial blood would issue from it. The communication would have become direct by communicating branches, and the capillaries would have returned to their accustomed duties.

During the first twenty-four hours after the division of an artery such as the femoral, or the application of a ligature, the temperature of the limb is commonly diminished; after that period, and as the action of increase takes place, the temperature is usually from three to five degrees higher than in the opposite healthy limb. At the end of from eighteen to twenty-eight days, in a successful case, the temperature is found to be equal in both.

It is asserted by some sanguine supporters of the all-powerful influence of the collateral circulation, that it is sufficient at all times, and under all natural circumstances, to maintain the life of the extremity. The practice of the Peninsular war proved the fallacy of this opinion in too many instances, to admit of any doubt of its inadequacy to do so in the lower extremity after the division of the femoral artery, under ordinary circumstances. The fact of enlargement or of a new development of vessels having taken place after the commencement of the disease, or the reception of the injury has been demonstrated by dissection, and it is through them the life of the limb is to be preserved.

It is most reasonable to conclude, that the collateral branches begin to enlarge shortly after the commencement of the disease, as a part of the curative process which nature endeavours to set up in most instances; the essential points of which are, in an extremity, 1st, the obliteration of the canal of the artery immediately above, and generally below the tumour; 2nd, the coagulation of the blood within it; 3rd, the enlargement of the collateral branches above and below it.

When a limb is lost through mortification, as the consequence of a division or obstruction of the principal artery, it usually takes place after the infliction of a sudden injury, in consequence of the collateral branches not having had time to enlarge.

In my work on injuries of arteries, and in this place, treating of the collateral circulation, I have asked the question:—"If the femoral artery be punctured near the groin, and a diffused aneurism form in a few days, extending up to Poupart's ligament; can the operation of placing a ligature on the external iliac be performed on the same principle, or with the same hope of success, as if the case had been one of true aneurism of several weeks' or months' formation? The answer is in the negative. The Hunterian theory of aneurism is not applicable to the case. The surgeon who placed a ligature on the external iliac, under such circumstances, would probably lose his patient from mortification, because the collateral branches would not yet have had time to enlarge." I may now add, if he should escape this danger, there is the risk of inflammation of the peritoneum which has occurred to myself and to several others, and of the formation of matter behind it; or the wounds if not closed may bleed, or the diffused and spurious aneurism may enlarge from blood flowing into it from both ends of the artery, which are not partially closed, as in true aneurism; or it may suppurate, and burst, and require in each case another operation, in order to suppress the bleeding. It is an operation which I shall show you cannot be supported on principle, which has not succeeded in practice, and which will be resorted to hereafter only as a last resource, when those means I have pointed out, have unfortunately failed; and when in all probability it will fail also.

The operation for placing a ligature on the subclavian artery, above the clavicle, in a case of wound of the axillary artery in the armpit, is equally inadmissible with that for applying a ligature to the external iliac for a wound of the artery in the groin, and ought alike to be abandoned. These are grave questions which interest the public more than the profession. They only indirectly affect the anatomist and the surgeon, who does one operation with the same degree of knowledge and ability as the other. To the public, to the sufferer, they are questions of life or death. By that operation, which during the war in the Peninsula was found to be efficient, the sufferer has a fair hope of recovery; after the Hunterian operation, he may live through accidental circumstances only, which may be prayed for, but which can never be honestly and fairly expected. They should never therefore be trusted to, for nothing which is dependent on chance or accident can or ought to become a principle in surgery. The Hunterian theory of the cure of aneurism is totally and utterly inapplicable to the treatment of wounded arteries, accompanied by an open wound, however small or distant. It is always doubtful, and frequently dangerous and destructive even where the external wound has healed. A wounded artery should always be secured at the part where it is injured, and the greater number of those who suffer from such accidents, and are not so treated, will in all probability be lost, unless surgery can come to their assistance by ulterior and more painful operations.

When an aneurismal limb has been injected, on which an operation has not been performed, the collateral vessels have all been found larger and more fully shown than on the opposite side, although not to the same extent as in cases of a similar nature in which the operation has been done.

It is necessary that this enlargement of the collateral branches should take place at an early period, because in many cases of aneurism the artery beyond or below the tumour is obliterated long before any operation is performed. The main supply of blood has been already cut off from the extremity, and the operation adds very little to the derangement of the circulation which has for some time taken place below the tumour. The following case shows the increase of collateral vessels so as to double the number on the opposite side.

CASE 19.—Alexander M'Donald, 28th regiment, was admitted into Hilsea Depôt Hospital, for a gangrenous spot on the great toe of the right foot, which soon got well. Twelve days after his admission, a pulsating tumour was first observed in the ham of the same side. On the 7th of August the tumour was of the size of an egg, and the arterial action strong in every part of the body. He died suddenly, and on examination the right femoral artery, or of the diseased side, was larger than that of the left. The aneurism was situated exactly at the spot where the popliteal artery divides into the posterior and anterior tibial arteries, and was of the size of a walnut. The posterior tibial opened directly into the sac. The orifice of the anterior tibial artery, which had originally opened into the sac, was closed, as well as about three-eighths of an inch of the vessel. Within the space of six inches above the aneurismal sac, the artery gave off fourteen branches in pairs, larger than those in the opposite limb, which were only seven in number.

These facts appear to me to be conclusive: they show that the collateral circulation is not the same, and is not in the same stage of preparation, in a limb suffering from a divided or wounded artery, as in one in which an aneurism has for some time existed; and they also show why mortification is more common after wounded arteries than after operations for aneurism.

CASE 20.—Private J. Barnes, 29th Regiment, on the 16th of May, 1811, at the battle of Albuhera, received a musket ball in the right thigh, behind and above the knee, inclining downwards and inwards, close to the condyles of the femur, and in the direction of the femoral artery becoming popliteal; it bled violently at the moment, and so continued for a few minutes, during which time he conceives he lost two quarts of blood. It then ceased, and he was dressed in the usual slight manner, and remained two days upon the field of battle, until removed to Valverde, nine miles, on a bad road, and on men's shoulders, in a blanket converted into a bearer. He was considered as one of the slighter cases, until the gentleman in immediate charge of him requested me to see him, on account of his toes being in a state of mortification.

On the evening of the 3rd of June, eighteen days after the accident, the man was placed on a bullock car, to be removed with the rest of the wounded to Elvas; the mortification of the foot having ceased to increase, and a line of separation having been formed. Shortly after the cars moved, I was informed that he was bleeding from the wound: it evidently appeared to flow from the popliteal artery; and as it issued slowly, I supposed from the lower divided end. The foot being partly lost, I determined on amputation above the knee, which was performed at Olivença. The amputated limb was sent after me to Elvas, that it might be examined at leisure. I carefully traced the course of the wound, and found in it a little coagulated blood, but could not see the mouth of the vessel. A probe passed into the upper end of the artery was obstructed before it reached the ulcerated surface by nearly an inch; and on passing it up the lower one, it was stopped exactly in the middle of the track of the ball, by a veil or substance drawn across the mouth of the vessel, which, on careful examination, showed the point of the probe at one part of the circle, although too small to let it through; from this part I conceive the hemorrhage came. The divided ends were one inch apart. The upper, or femoral portion, for near an inch, contained a firm coagulum, filling up that part of the artery which had contracted like the neck of a claret bottle. The lower or popliteal portion of the artery had a very peculiar appearance; the substance drawn across appeared to have closed it completely at one time, and to have given way from the rough motion of the car at the point now open, and which is very small even when the sides of the artery are approximated. A very little soft coagulum was behind it; and if the man had not been removed, the vessel might have remained secure. This case shows very distinctly the means adopted by nature for the suppression of hemorrhage from both ends of a divided artery. The preparations I shall place in the Museum of the College of Surgeons.

CASE 21.—In another soldier, under similar circumstances as to the nature of the wound and mortification of the foot, no hemorrhage took place on the journey to Elvas, but the man died three days after from mortification of the leg He did not remain under my direction at Elvas, and no examination of the limb was made.

Case 22.—Serjeant Baptiste Pontheit, of the French 64th regiment, was wounded by a musket ball at the battle of Albuhera, on the upper and fore part of the thigh, which passed out behind, in the direction of the femoral artery. He lost a great quantity of blood at the time, to the best of his recollection, and the wound went on well until the 26th, ten days after the battle, when he felt something give way in his thigh, and found himself bleeding from the wound, which however soon ceased on pressing his hand upon it. In the afternoon on again moving, he lost about half a pint of florid blood, which induced the surgeon on duty to place a tourniquet on the limb, and inform me of the circumstance. When at leisure (in the course of two hours) I removed the tourniquet, and as no hemorrhage occurred, and there was no swelling in the vicinity of the wound, I replaced the dressing with a precautionary screw tourniquet, explaining to him its use, and the probable nature of his wound, together with the operation requisite to be performed in case of further bleeding.

I should before have mentioned that he was not a strong man, and was exceedingly anxious about his situation, and very restless: on turning at night he lost a little more blood, which ceased by his tightening the tourniquet, which was shortly after loosened. In the morning, every thing being removed, there appeared some swelling about the wound, the opening of which was filled up by a coagulum : gentle pressure being made, it readily turned out, and was followed by a stream of arterial blood, leaving little doubt of the femoral artery being wounded. Compression being made in the groin, I made an incision three inches and a half in length, taking the wound as a central point, and exposed the femoral artery and vein: both were wounded, the former being half destroyed in its circumference, surrounded with coagulated blood, and appearing as if it had sloughed from being touched by the ball, the course of which was directly past it, and I conceive would have carried it away, if it had not been for the elasticity of the artery. A ligature placed above, and another below the wound, secured both artery and vein ; the incised wound was brought together by adhesive plaster, and the limb placed in a relaxed position. The operation was of short duration ; he lost little or no blood, but the circulation was very languid, and the man exceedingly low. The warmth of the leg and foot was soon below the standard of the other; warm flannels were applied, and some brandy and water was given to him. In the evening the heat was more natural, and the man returned thanks for the humanity and kindness shown to him, congratulating himself and me upon the success of an operation which he had supposed to be infinitely more severe. The next morning he ate a tolerable breakfast, but felt a pricking sensation in the calf of the leg, which was as warm to the hand as the other, but the foot was cold. The second day, the swelling of the limb, its appearance, and discoloration on the under part, indicated approaching mortification, which on the 3rd was evident, and on the 4th at mid day he died, the limb up to the wound being nearly all in a gangrenous state. No adhesion had taken place in the wound, or in the artery, which showed the inner coat cut, the ligatures being firm, and no coagulum behind them. In this case, nature appeared from the first quite unequal to carry on any of the necessary operations ; which may have arisen from the very debilitated state of the patient, as well as from the double obstruction to the circulation. He was a very gallant soldier, had been in twenty battles, was to me an object of solicitude, and had every attention it was in my power to bestow. He begged me to keep his watch, and although it is worth nothing, I do keep it as a relic of by-gone days.

Case 23.—Captain St. Pol, of the 7th or Royal Fusiliers, a son of his Majesty Louis Philippe, King of the French, by an English lady, was wounded in the ham from behind, whilst in the ditch at the foot of the great breach at Badajos. He fell instantly, and lost as he thinks, a considerable quantity of blood. On recovering he was raised from the ground, and walked a few paces prior to his being carried to his tent, where I saw him in the afternoon of the next day, the 7th. The leg had ceased to bleed before his arrival in camp. A substance could be felt on the inner side of the patella, which by the sensation communicated to the finger on moving, appeared to be the ball, which was extracted. A small artery was accidentally divided, and some dark-coloured blood also issued from the cavity; the ball was lying loose and unconnected ; the finger on being passed into the joint which was swollen, discovered no splinters of bone, and the entrance of the ball behind would not admit the finger. His having walked some distance on the leg, and the absence of any splinters between the articulating extremities of the bones, induced Dr. Armstrong, the surgeon of his regiment, and myself to think that the ball had entered with little injury to the bone ; and after stating to the patient the little hope we had of ultimately saving the limb, independently of the great danger to which he was exposed, compared to the certainty of the operation of amputation at the moment, to which he would not consent, we assented to his retaining the limb for the present, thinking he would at least get through the inflammatory stage, when the operation could be performed satisfactorily to himself, although under much more unfavorable circumstances. The next day he was removed into Badajos on a litter, the heat of the tent being insupportable.

On the morning of the 9th I saw him early, being a friend in whom I took the greatest interest, when the want of circulation in the foot was evident from its having lost its natural colour and warmth; the knee was swelled, but not painful, and I had no doubt that the artery had been divided by the ball. The marbled appearance and tallow-white colour soon indicated the loss of the leg above the calf; and vesications formed on the foot, already of a green colour.

On the 12th the extent of the gangrene was defined, on the back of the knee up to the original wound at its lower edge, gradually receding as it advanced to the fore-part of the leg, which for three inches below the knee was apparently sound; the uneasiness of the knee being moderate, and the incised wound looking perfectly healthy, although the latter had not united.

On the 16th the separation of the dead from the living parts having taken place behind, and being well marked and commencing on the fore part, the limb was amputated as low down as possible. Sixteen vessels were tied ; the parts were gently brought together, without any hope of union.

On the 18th, there being some swelling of the stump, the strips of plaster were removed, one only remaining as a support to the vessels.

20th. Half the ligatures came away at once, they having gradually formed into two parcels ; the stump was quite open, the bone well covered, and good granulations appearing, with a great discharge of well formed matter.

On the 22nd, his want of strength to carry on the necessary actions became apparent.

On the 24th, he died.

On examining the amputated limb, the popliteal nerve was found untouched, the ball having passed on the inside; the popliteal vein was also entire, having a small tumour adhering to its under part between it and the artery, the divided end of which was closed by a yellowish green firm substance, readily distinguishing it from the surrounding parts. On clearing the whole from the bone, and making a small circular opening into the tumour, which was elastic and covered with brown fibrous layers, it proved to be an aneurismal sac, smooth on the inside, containing florid arterial blood, and some little coagula. The cavity of the sac was not perfectly regular, being nearly divided on one side by a process running into it. The artery, on being carefully opened to the closed end, appeared to have been injured above the part divided by the ball, and communicated with the sac by a small fissure or rupture. The end of the artery was then slit up, so as to show the very little thickness of the closing substance, and the great original contraction of the diameter of the vessel. There was no internal coagulum, neither was there any laid over the external part of the artery; between it and the bone there was a coagulum lying of the size of a small phial cork. Displeased with myself for having listened to Captain St. Pol's petition for delay, which I knew even under more favourable circumstances had been futile, I felt a melancholy satisfaction on viewing the diseased parts, which showed that process of nature in closing the artery completed, which in the former case had only been begun, although a longer period of time had elapsed.

We were inclined to suppose that the aneurismal sac existed prior to and independent of the gun-shot wound, considering that a sac of that nature could not be formed in ten days. Captain St. Pol did not remember any injury to have happened to, or any painful sensation to have existed in the knee before the accident; but Dr. Armstrong recollected his having once or twice mentioned some uneasiness in it, but in so casual a manner as not to have caused further inquiry. The other end of the artery I could not find from the gangrenous state of the parts. He was a remarkably handsome young man, and died beloved and regretted by every one.

Case 24.—Private P. Turnbull, of the grenadiers of the 74th regiment, of good stature, was wounded on the 10th April, 1814, at Toulouse, by a musket ball passing from the inside to the outside of the middle of the thigh; he says it bled considerably at first, but soon ceased; the wound was not painful, and he thinks he observed the leg and foot to be colder than the rest of his body for the first two or three days, but did not much attend to it, further than conceiving the numbness, coldness, and impeded power of motion as natural to the wound.

On the 18th of April the gentleman in charge of this patient pointed him out to me as an extraordinary case of gangrene coming on without any, as he suppesed, sufficient cause; the wound on the outside of the thigh, or the exit of the ball, was nearly healed, and that on the inside was without inflammation or tumefaction, and with merely a little hardness to be felt on pressure. The pulsation of the artery could be distinctly felt to the edge of the wound, but not below it; the leg was warm, the gangrene confined to the toes. The artery of the other thigh could be distinctly traced down to the tendon of the triceps. As he was at a small hospital, about two miles from town, on the field of battle, I did not see him until the 20th, and again on the 23rd, when, although the gangrenous portion included all the toes, it had the appearance of having ceased. Satisfied that it would again extend, I left directions with the assistant-surgeon that the limb should be amputated below the knee.

The surgeon, whom I had not seen, and who did not understand the subject, disobeyed the order, conceiving that there must be some mistake. At daylight on the 25th I was greatly annoyed on finding that the operation had not been done, and that the mortification had begun to spread the evening before. It was then too late. On the 26th it was above the ankle, with considerable swelling up to the knee. At night the man died; and the next morning at six o'clock I removed the femoral artery from Poupart's ligament to its passage through the triceps, which part was affected by the mortification.

The ball passed between the artery and vein in the spot where the vein is nearly situated behind it, and adherent only by cellular membrane, through which the ball made its passage, the coats of the vein being little injured, and those of the artery not destroyed in substance, although bruised; it was at this spot much contracted in size, and filled above and below by coagula, which prevented the transmission of blood, and the vein above and below the wound was filled by a coagulum, and was also impassable. This preparation is unique, and is perhaps the only one in existence proving the elasticity which vessels possess, and their capability of avoiding to a certain extent an injury about to be inflicted upon them. It will be hereafter in the museum of the Royal College of Surgeons, for public inspection.

Case 25.—After the battle of Salamanca, I was requested to see a soldier of the fifth division, who had received a shot in the thigh nearly in a similar place, which had been followed by gangrene of the toes, not extending to the instep. The correctness of my opinions not being at that time acknowledged by my friend the surgeon, who showed the case to me from knowing my desire on the subject, he did not amputate when the mortification began to spread suddenly, and this man also died on the day after that occurrence.

Case 26.—A Portuguese, at the same battle, suffered from a wound of a similar nature, but rather lower in the thigh. The mortification which followed was confined however to the great toe only, and great hopes were entertained that it would not spread, when hemorrhage unexpectedly took place from the wound, and the artery was tied some distance above it. The hemorrhage returned and was suppressed, but the patient sunk and died. On examination it was found that an additional, but this time an accidental error had been committed (I have seen it done since in London), and a large branch from the femoral artery running parallel with it had been tied instead of the wounded artery itself, which had yielded by ulceration, not having been cut in the first instance.

Case 27.—Don Bernardino Garcia Alvarez, captain of the regiment of Laredo, thirty years of age, was wounded at the battle of Toulouse by a musket ball, which passed through the thigh, a little above its middle. The wound was not considered a dangerous one until the 30th, twenty days after the injury, when a considerable bleeding took place; and as the vessel from which it came seemed to be very deeply seated, the Spanish surgeon in charge tied the common femoral artery. I saw the gentleman in consequence of this having been done. The hemorrhage was suppressed by the operation, and the limb soon recovered its natural temperature, but gangrene made its appearance on the great toe on the third day afterwards. It did not seem to increase, but the limb swelled as if nature was endeavouring to set up sufficient action to maintain its life, and this continued until the tenth day after the operation, when he died completely exhausted. On the dissection of the limb, the femoral artery was found to be perfectly sound in every part below where the ligature had been applied. The vessel which bled could not be discovered; but it was certainly a branch from the profunda, and not the femoral itself. In this case the ligature of the femoral artery destroyed the patient, and the practice pursued must be condemned. The gunshot wound should have been largely dilated, at both orifices if necessary, until the wounded vessel was discovered, which was in all probability not completely divided by the ulcerative or sloughing process which had taken place, and its division would in all probability have suppressed the bleeding. I shall refer to this case hereafter.

Cases of wounded arteries were not numerous after the battle of Waterloo, as far at least as they were observed in the hospitals in Brussels and at Antwerp.

Case 28.—In one which occurred in a French prisoner in the Gend'armerie Hospital, and for which the femoral artery was tied, it proved fatal from gangrene of the foot and leg.

Three cases have occurred at the Westminster Hospital under my observation, in which mortification of the leg took place from injury to the popliteal artery. The two first were not under my care, and were both in my opinion lost, in consequence of the early signs of loss of life not being recognised until too late. They both died waiting for the mortification to stop by the establishment of a line of separation between the dead and the living parts, which under similar circumstances rarely takes place. In both these cases the amputation should have been done immediately above the knee, including and removing all the injured parts, and before inflammation had set in to any extent.

Case 29.—A lady suffered from mortification of her right leg, without any obvious cause, and desired my attendance. The mortification resembled so much that which follows a divided artery, that I immediately examined the thigh, and found the femoral artery up to Poupart's ligament had become a hardened cord, without pulsation. She had suffered an attack of inflammation in it. A line of separation having been formed behind the knee, I amputated the thigh immediately above it. The lady died some days afterwards; and the limb and the artery are in the museum of the College of Surgeons.

The result of amputations, after a line of separation had been formed, during the Peninsular war, was not favourable; it was in fact so much the reverse, when the constitution of the sufferer was impaired by disease or was otherwise unsound, that I was led to abandon it in many instances, and to adopt a different proceeding in the following case, which deserves consideration, inasmuch as I have little doubt that death would shortly have followed after an amputation.

Case 30.—Richard Cook, aged fifty, a mason, whilst sitting on a square block of stone, on the 23rd February, was struck by another, which drove the popliteal space or ham against the edge of the block on which he sat, giving him great pain, and otherwise greatly bruising the leg, although no bones were fractured, nor was the skin torn. The limb on his admission, half an hour afterwards, into the Westminster Hospital, was much larger than the other, and of a dark reddish-blue colour, evidently from the bruise or extravasation of blood, which appeared to be still issuing from the vessel or vessels, as the limb continued to increase in size until it became at last greatly swollen. The pulsation of neither the anterior nor the posterior tibial artery could be distinguished through the swelling the next morning. The bowels were opened, and a cold spirit lotion was applied to the calf, and around the leg, and the swelling somewhat subsided, the limb becoming quite a blue black, which, with the tenseness of the parts, distinctly indicated the effusion of a large quantity of blood. It was soon obvious that greater mischief had occurred than had been expected, and on the 2nd of March, as vesications filled with a bloody fluid were formed on the outside of the leg over the fibula, and the whole limb was manifestly about to pass into a state of gangrene, if it had not already done so, I prepared everything for tying the popliteal or other arteries, if found necessary, and made a long and deep incision on the outer and back part of the leg, through the integuments and muscles, posterior to the fibula, and removed a considerable quantity of coagulated blood from between the muscles and from a large cavity which extended upwards into the ham, without causing further hemorrhage, and in no part of which cavity could an artery be felt. The patient's countenance and body had assumed a jaundiced hue, the pulse was very quick, the tongue foul, the countenance sunken, the skin hot, the head wandering. Poultices of linseed meal and stale beer were applied, with gentle stimulating applications. Brandy and wine were ordered in proper quantity every hour or two, with sufficient doses of the muriate of morphia at night to allay irritation, and induce sleep. The incision, together with these remedies, gave great relief, and on the 7th the man seemed to have been saved from a state of the most imminent danger. On the 8th the pulse was 112, the tongue clean, the skin of a whiter colour, the bowels opened by injections; eight ounces of brandy were given in the twenty-four hours; wine, with sago, arrow-root, jelly, oranges, and anything he chose to ask for. The greatest cleanliness was observed, and the chloride of lime was used in profusion all around him. The mortification of the limb was complete, a line of separation formed about four inches below the knee in front, and extended behind towards the ham. On the 26th, the dead parts having almost entirely separated from the bones all round, those which remained were cut through where dead, and the bones were sawn through about five inches below the knee, and the lower part of the limb removed, leaving an irregular and in part granulating stump, with an inch of bone projecting from it. On the 24th of May this portion was found to be loose; diluted nitric acid had been applied to its surface, and on the 20th of June it separated. On the 16th of August Cook left the hospital in good health, with a very good stump, having cost the hospital £57 in extra diet.

In this case, there can be little doubt of the popliteal artery having been torn, and if the incision made on the 2nd had been had recourse to during the first two or three days, and the artery sought for, and secured if found bleeding, it is possible the mortification might have been prevented, although it is probable, from the pressure arising from the great extravasation and coagulation of blood, that the collateral circulation was so much impeded as not to have been able to maintain the life of the limb below, even during that time. The incision made on the 7th saved the life of the patient by taking off the tension of the part, and relieving thereby in a remarkable manner the constitutional irritation which hourly appeared likely to destroy him; indeed, no one expected anything but his dissolution. When the line of separation had formed, he was evidently unequal to undergo the operation of amputation, to make a good stump without great risk, and the dead parts were therefore merely separated for the sake of cleanliness and comfort. Experience has demonstrated in too many cases of the kind that the formal operation of amputation at this time as recommended by most modern surgeons would in all probability have cost him his life.

Case 31.—In 1834 I placed a ligature of strong dentist's silk on the right common iliac artery of a lady of middle age for a swelling in the hip, supposed to be a gluteal aneurism, and which, after commencing the operation, was found to occupy a considerable part of the iliac region. The lady died a year afterwards, and it was then found that the ligature had been applied at the distance of five-eighths' of an inch from the bifurcation of the aorta, and three-eighths of an inch above the origin of the internal iliac, independently of the line of separation between the parts of the iliac divided by the ligature, and which did not seem to be wider than the ligature itself. The separated ends were united at the point of separation by new matter, the orifice or end of each being closed by a very narrow barrier, the inner coat of the artery being redder than natural, somewhat irregular and contracted, and containing hardly any coagulum, thus proving the fact, in the largest artery in the body save one, that a coagulum is not necessary for the safety of the union, while the immediate vicinity of so large a vessel as the internal iliac, to say nothing of the aorta itself, also proves that the danger hitherto expected from the neighbourhood of a collateral branch is more imaginary than real—two great facts the practice of the Peninsular war led me to declare, and which can no longer be doubted.

The preparation exemplifying these points is in the Museum of the Royal College of Surgeons, together with the ligature, still carrying in its noose the portion of the artery it strangulated and brought away with it.

The mortification of the extremity, which, from what I have said, might reasonably have been expected to take place from a defective or unestablished collateral circulation, was, I apprehend, prevented by keeping up a regular gentle friction, by the hands of a nurse, on the foot and leg up to the knee, almost without intermission, for the first twenty-four hours, and at short intervals afterwards, until the re-establishment of the circulation could not be doubted. I had previously tried it in a case of inguinal aneurism, for which I had placed a ligature on the external iliac artery, less than an inch from its origin from the common iliac, by a similar operation, not knowing which vessel I should have to tie, from the extension of the tumour upwards, in which case it succeeded equally well; and I am not without hope that if this practice should be duly followed up in all cases of wounded arteries of the lower extremity, and in some of the upper, that the danger from mortification may be greatly obviated.

Some practical deductions may be made from these facts.

1. That the theory of the operation of aneurism, as dependent on the collateral circulation, cannot be applied with safety to spurious aneurisms of recent occurrence dependent on wounded arteries.

2. That it is inapplicable to wounded and bleeding arteries.

3. That the length of time a spontaneous aneurism has existed is of consequence, as connected with the collateral circulation; although an aneurism should never be allowed to attain that size which may render it injurious to the surrounding parts.

4. The collateral vessels are at all times and under all natural circumstances capable of carrying on the circulation in the upper extremity, whatever disease or injury may affect the principal trunk, provided a due degree of care be taken to maintain the temperature of the part. Whenever the reverse takes place, it is an exception to the general rule.

5. After operations for aneurisms in the lower extremity, the collateral branches are almost always equal to carry on the circulation through the limb.

6. When the principal artery of the lower extremity is suddenly divided, without any previous disease having existed, mortification is not an uncommon occurrence, and is more likely to take place in old than in young persons.

7. When under such circumstances the principal vein is also divided, mortification seldom fails to be the consequence.

# LECTURE III.

*Effects of the application of a ligature; Division of the inner and middle coats; Curling inwards of the inner coat; The inner coats affected by adhesive inflammation; The outer coat yields by ulceration, or sloughing; Contraction of the vessel, and inflammation of its coats above the ligature; Formation of the small tapering coagulum; The coagulum not absolutely necessary to the permanent closure of the vessel; The presence of a collateral branch immediately above the ligature does not always prevent the closure of the artery; The power which suppresses hemorrhage in a bleeding artery, is in the very extremity of the vessel itself; A ligature should be round and small; Strength of the ligature; Selection and proper application of a ligature for unhealthy arteries; Ulceration of the inner coat of the vessel; Occurrence of secondary hemorrhage; Case of wound of the ulnar artery, with ligature of the brachial, terminating fatally; Case of wound of the brachial artery, the vessel tied at the seat of injury, terminating successfully; Case of extensive injury of the anterior tibial artery, with ligature of the femoral, followed by secondary hemorrhage, amputation, and death; Case of wound of the posterior tibial, ligature of the femoral, secondary hemorrhage, amputation, and death; Case of wound of the femoral, the Hunterian operation, formation of an abscess, secondary hemorrhage, amputation, and death; The Hunterian operation not applicable to wounded arteries; Mr. J. Bell's case of wound and false aneurism of the gluteal artery; Mr. Carmichael's case; Professor Baroni's case; Baron Dupuytren on aneurisms complicating fractures, and wounds by fire-arms, and their treatment by Anel's operation; M. Delpech's case; Baron Dupuytren's case of false aneurism from pistol-shot wound of the leg, with successful ligature of the femoral artery; Remarks on his practice; Case of diffused aneurism of the thigh, following fracture of the femur, terminating by fatal mortification; Case of true popliteal aneurism, becoming diffused by rupture of the sac; incision into the false aneurism, amputation, and death; Sir Astley Cooper's case of ligature of the femoral, from wound in the leg, secondary hemorrhage, and amputation; Mr. S. Cooper's successful case of ligature of the femoral, for wound of the leg; Mr. S. Cooper's successful case of ligature of the popliteal artery, for a wound in the calf of the leg; Mr. Guthrie's successful case of ligature of the perineal artery at the seat of injury; Mr. Hall's successful case of ligature of the posterior tibial artery at the seat of injury; Mr. Arnott's successful case of ligature of the posterior tibial artery at the seat of injury; Mr. Roche's case of ligature of the posterior tibial artery for aneurism after amputation; Mr. Collier's case of ligature of the posterior tibial for secondary hemorrhage after hospital gangrene; Mr. Stanley's cases; The operations for placing a ligature on the posterior tibial artery; All such wounds, and all recent aneurismal swellings resulting from them, are to be treated by incision, and the application of the ligature to the artery.*

There are few points in surgery on which a greater difference of opinion has taken place, than on the best manner of placing a ligature on an artery, and on the effects which follow its application.

When a round and small ligature is properly applied to an artery of a large size, such as the femoral, the sides of the vessel are brought together in a folded, plaited, or wrinkled manner; the inner and middle coats of the artery are divided, the outer one remains entire and apparently unhurt. If the ligature be removed, an impression or indentation made by it on the outer coat will remain as a mark; and if the artery be slit open in a careful manner, the division of the two inner coats will be obvious. These changes were known to Desault, and are mentioned by Deschamps in his work on the Ligature of Arteries. They were more satisfactorily proved to occur by Dr. Jones; and have been clearly stated by Mr. Hodgson and others. The remaining part of the process differs from the account they have given, and from observations I have had opportunities of making on the living and the dead, is as follows:—The inner and middle coats are not only divided, but the inner one particularly appears to be curled inwards on itself, so that the cut edge of one half or side is not applied to its fellow in the usual way of two surfaces, but by curling inwards meets its opponent on every point of a circle, and in this way forms a barrier inside that of the external coat, which is tied around it by the ligature: so that in fact when a small ligature is firmly tied, its direct pressure is not applied to the inner coats, which have been divided, and have curled away from it, but to the outer one, which is in consequence of that pressure made to ulcerate or slough, which processes could scarcely fail to take place also in the other coats, if they were subjected to pressure in a similar manner. The cut edges of the two inner coats, being from this provision of nature perfectly free, are capable of taking on the process of inflammation, which stops at the adhesive stage. This they do by the effusion of lymph or fibrin both within and without, to a greater or less extent as the case may require. The outer coat of the artery must either yield by ulceration or sloughing, or the ligature must remain until it is decomposed and destroyed. The artery usually yields by sloughing, and the ligature is left at liberty by the ulceration which takes place in the sound part of the artery immediately above and below the part strangulated by the ligature, and which part is frequently brought away in the noose. The artery does not always yield by sloughing, particularly if it is a large one, and the ligature has been thick and soft. In this case, a part of the outer coat, from its folding or plaiting under the ligature, seems to escape that degree of pressure necessary to destroy it, and when the remaining part yields, it remains entire, and is only removed by a subsequent process of ulceration, occasioned by its irritation as an extraneous body. I have had the opportunity and the misfortune of examining great numbers of stumps after amputation and death, and I have seen this occur in so many instances as to leave no doubt of the fact.

In these cases, the external coat could not close around the inner ones; and this shows that they are capable of forming an effectual barrier without it, although it materially assists in giving greater strength to the cicatrix, by the effusion of fibrin which takes place within, without, and around.

Whilst this process is going on without, and at the very extremity of the artery, the vessel is gradually contracted above it, and its coats become more or less inflamed, soft, and vascular. The inner coat is seen to be wrinkled transversely, and a small coagulum of blood is formed within it. This sometimes completely fills the artery, but it is more common for a small tapering coagulum to be formed, adhering by its base to the extremity of the inner coat; the white colour of which renders it distinctly observable, when contrasted either with the coagulum, or the inner coat of the artery, which latter is usually of a red or scarlet colour, whilst the inflammatory action is going on. My observations have led me to believe that a coagulum is not absolutely necessary to the permanent closure of the artery, although it certainly assists in maintaining it. An artery is also supposed to contract gradually up to its first collateral branch; but this is not always the case, and depends entirely on the use for which the branch is required. After amputation at the middle of the arm, the artery will go on diminishing in size up to the subscapular branch; the circumflex arteries diminishing in proportion, in consequence of their being so much less necessary than before the operation. I have seen several instances in which the principal artery has remained pervious below the collateral branch, the next immediately above the part where the ligature has been applied. Neither will the presence of a collateral branch immediately above where the ligature has been placed upon the artery always interfere with the consolidation of the wound, and the closure of the canal of the vessel. It may impede the process, and render it for a time less safe, and in some instances prevent it altogether. I have so often seen large arteries heal after division close to the giving off of a considerable branch, that I consider them to be always capable of doing so, provided they are naturally sound. If they are not sound, it is very doubtful what process may take place; but it will be less likely to be a healthy one, if interfered with by the immediate proximity of a collateral branch. The power which suppresses hemorrhage in a bleeding artery, resides however in the very extremity of the vessel itself.

A ligature should always be round and small; provided it be sufficiently strong. The strength of a ligature is variously estimated; some surgeons trying it by the strength of their own fingers, others by what they conceive to be the resisting power of the coats of the artery, in which perhaps they may err. The only way in which a surgeon can hope to acquire correct information on this point, is by trying on the dead body what force of fingers is required to cut the inner coats of arteries of various sizes; and then taking the least force required for this purpose, to ascertain whether he can easily pull the ligature over, or off the divided end of the artery. If a surgeon will take the trouble to do this, he will find that he has estimated the necessary force much too highly, and that he is in more danger by breaking his ligature than of failing to secure the artery. Hemorrhage has however been known to occur from the ligature having slipped off the end of an artery, which had been divided in the operation for aneurism, although I have never seen it happen after amputation, where the vessels were tied with a small firm ligature. It constitutes a valid objection to the division of the artery between the ligatures, when two are applied.

A ligature composed of one strong thread of dentist's silk, well waxed, is sufficiently firm for the largest artery. It does not however much signify what may be the shape, size, form, or substance of ligatures, when they are applied to arteries in a sound state, provided they are not too large, are fairly and separately tied, and with a sufficient degree of force to retain the ligature in its situation until separated by the usual processes of nature, which generally take from fourteen to thirty days for their completion.

When arteries are unhealthy, the selection and proper application of a ligature are points of great importance. A small round ligature should be fairly, evenly, and firmly although not too forcibly applied, without the intervention of any substance whatever between it and the cellular covering of the artery. The secondary hemorrhages, which are recorded by different writers, took place I am disposed to believe, more from the application of improper ligatures than from any other cause; for the inner coat of an artery is so prone to take on the adhesive state of inflammation, that if a strong small ligature be applied in the manner directed, it is more than probable that the closure of the artery will be effected. Ulceration will however sometimes take place on the inner coat of the vessel, and slowly extend outwards, undoing in its progress any steps which may have been begun for the consolidation of the extremity of the artery. When a secondary hemorrhage does occur from this or any other cause, it is usually from the beginning of the second to the fourth week; but there is no security for the patient until after the ligature has come away, unless it is retained an inordinate length of time from having included some substances which do not readily yield under irritation, such as the extremity of a nerve, or a slip of ligament which is not sufficiently compressed in the noose of the ligature.

Secondary hemorrhage may also take place from the extension of ulceration or sloughing to the artery from the surrounding parts, and perhaps as frequently as from any other cause; but when mortification occurs, there is no secondary hemorrhage, unless in that species which is called hospital gangrene. The advantages to be derived from the application of a strong small ligature, from the least possible disturbance of the surrounding parts, and from absolute quietude, whilst the healing processes are going on, must be so obvious as to require no further observation. Secondary hemorrhage has been shewn to be the consequence of motion of the limb at too early a period; and an undue interference with the ligature, by pulling at it, cannot be too earnestly deprecated, as likely to give rise to it in a similar manner.

The senior Louis in his Memoire sur les tumeurs fongueuses de la dure mére, page 3, published in the Memoires de l'Academie de Chirurgie de Paris, says, "Our knowledge, always too limited, is almost necessarily defective when it is not supported by a sufficient number of facts relating to the same object, which should be examined with the most scrupulous attention in all their different bearings." Sensible of the justice of these remarks, they must be my apology for the production of so many nearly similar cases, under the belief that they are essentially necessary for a due understanding of the subject to which they relate. They are all abridged to the utmost, consistently with a due preservation of their sense and meaning.

The brilliant theory of the cure of aneurism by the Hunterian method, and the more brilliant operations which followed it, superseded and almost obliterated from the minds of modern surgeons the recollection of the ancient method of proceeding with respect to wounded arteries. There was not a single surgeon to be found with the army at the first battle in Portugal in 1809, who doubted for an instant the propriety of its application to them, no matter in what school they had been educated, nor in what country they had practised their profession. I partook of the general persuasion which at that time prevailed in England, but was fortunately on the very first occasion, at the battle of Roliça led to doubt, and shortly afterwards was convinced not only of its inapplicability but of its inefficiency.

CASE 33.—Corporal Carter, of the pioneers of the 29th regiment, was wounded at the battle of Roliça in August, 1809, by a musket-ball, which passed through the anterior and upper part of the forearm, fracturing the ulna. Shortly afterwards a profuse hemorrhage took place, and the staff surgeon in charge tied the brachial artery. In the night the hemorrhage recurred, and the man nearly bled to death. The arm was then amputated, when the ulnar artery was found in an open and sloughing state.

*Remarks.*—A simple incision to expose the wounded artery and to place two ligatures upon it would have saved this man his arm.

CASE 34.—At the battle of Vimiera, which followed a few days afterwards, a soldier received a somewhat similar wound, save that the brachial artery bled forthwith, and was only stopped by the tourniquet. Warned by the preceding case, I cut down on the artery, carefully avoiding the nerve, which had been tied in the former instance, and found the artery more than half divided. It was secured by a ligature above and below the wound; the bleeding did not afterwards return, and the man recovered.

CASE 35.—Thomas Carryan, of the 3rd regiment, was wounded at Albuhera, on the 16th May, 1811, on the inside of the calf of the right leg, the ball passing out on the fore and outside of the tibia: it bled considerably for some minutes, when it ceased, and the hemorrhage did not return until the 15th of June, on which day a little blood followed the dressings, and increased on the patient making any exertion; so that, on the 4th, the gentleman under whose care he was, tied the femoral artery on the outside of the sartorius muscle, which suppressed the hemorrhage for that day, the limb continuing with little or no interruption of the same temperature to the hand as the other; on the 5th, the original wound had a bad appearance, and some coagulated blood was readily pressed out of it; on the 6th, a greater quantity came away; and, on the 7th, the exertion of using the bed-pan was followed by a stream of arterial blood, which ceased on tightening the precautionary tourniquet.

The limb was amputated above the ligature on the artery. Its dissection showed the anterior tibial artery to have been destroyed for some distance and the muscles on the back part of the leg nearly in a gangrenous state. The patient died a few days afterwards.

*Remarks.*—If an incision had been made on the leg so as to expose the artery, and a ligature had been placed above and below the wound, the man would not have died, as far as surgery was concerned.

CASE 36.—A private of the 5th division of infantry received a wound at the battle of Salamanca, from a musket ball, which passed across the back part of the right leg, from above downwards and inwards. It entered about two inches below and behind the head of the fibula, and passed out near the inner edge of the tibia. There was little blood lost at the time, and it was considered to be a simple wound;

eight days after the injury, some blood flowed with the discharge; this increased during the night, and on examining the limb on the morning of the ninth day, it was evidently injected with blood, which flowed of a scarlet colour from both orifices. It being doubtful which vessel was wounded, whether it was the trunk of the popliteal artery, or the posterior tibial or peroneal after its division into these branches, it was thought advisable to place a ligature on the femoral artery about the middle of the thigh, which suppressed the hemorrhage. The case was now shown to me, as one in proof of the incorrectness of the opinion I had a few days before stated, of the impropriety of such an operation being done. The seeming success did not long continue; hemorrhage again took place from the original wound, and the limb was then amputated. The posterior tibial artery had been injured, and had sloughed. The man died.

*Remarks.*—A straight incision directly through the back of the calf of the leg of six inches in length, and two ligatures on the artery, would have saved this man's leg and life.

Case 37.—James Murphy, of the 28th regiment, twenty-two years of age, was wounded at the battle of Waterloo by a musket ball, which passed through the thigh below its middle and in the course of the femoral artery, which was not, apparently, wounded at the time; but as the wound began to heal, it gave rise to an aneurismal swelling in the part, for which the usual operation for aneurism above the seat of injury was performed by Staff-surgeon Cole, on the 22nd of July, 1815, two ligatures being placed below the artery, which was divided between them.

On the 11th of August, matter was evidently collecting in the thigh, and on the 13th a counter opening was made at the inferior part of the thigh, in the line of the aneurismal tumour, and over the exit of the ball, and two ounces of a bloody purulent fluid were evacuated; four ounces of blood were lost in the evening from the wound.

25th. This morning, on rising to get out of bed, an arterial hemorrhage took place from the counter opening to the amount of about four ounces; pressure on the thigh by the tourniquet could not stop it, but it was arrested by compress and bandage, and the application of cold. The thigh in the evening appeared to be swollen.

26th. The bleeding recurred this morning, but was again arrested by pressure, but the thigh is enlarged and seems injected with blood. Amputation was now determined upon, and performed. The man sunk and died two hours and a half afterwards.

*Dissection.*—An incision was made in the direction of the aneurismal wound about an inch deep, which exposed the sac, containing a large quantity of coagulated blood of a dark colour, although destitute of fœtor; the blood was not confined to the sac, but was extravasated throughout the limb, the quantity altogether being at least one pound and a half. Another incision was made towards the knee, somewhat in the direction of the artery; and upon opening the tumour, which was beneath the fascia, there spouted out three ounces of thin matter of the colour of clay. No communication whatever could be found between this abscess and any other part.

The ball had passed through the rectus, vastus internus, and sartorius muscles, beneath the abscess but higher in the thigh, and immediately over that part of the artery which was diseased, but did not touch it, although it was the cause of disease in the parts around the artery and of the vessel itself, but the injury was not sufficient to bring on immediate hemorrhage. The artery was affected by extension of disease to it, and not by the direct contact of the ball, in the track of which nothing peculiar was observable. It communicated with the counter opening, and with that part where the blood was first effused.

*Remarks.*—The great error lay in making a new wound, and in tying the femoral artery as for an aneurism, instead of laying open the swelling. If this had been done, the man's leg and life in all probability would have been saved.

The Hunterian theory, the cause of death in these three men, as well as in many others before and since, is founded on the fact that the artery is, and has been for some time, in a diseased state immediately above and below the aneurismal sac—that if the sac were opened, or caused to inflame or suppurate, the artery could not be safely tied where it was diseased; that it is more likely to be found in a sounder state at some distance from the aneurismal tumour; that the operation is more simple when performed on parts in a healthy and natural state; and that the impetus of the circulation being taken off by the ligature, the blood in the shut sac would become stagnant, and consequently coagulate, and be ultimately absorbed. When the theory is applied to the treatment of a wounded artery, even with a narrow, much less an open wound, the absence of a sac to receive any regurgitating blood from the collateral or capillary vessels is overlooked, together with the hemorrhage which must necessarily follow from the want of such a retaining membrane, unless the divided ends of the vessel should have been closed by some accidental rather than expected process of nature, before the collateral or capillary circulation could become efficient. The previous soundness of the artery at the part injured is overlooked; the danger of mortification from a deficient collateral circulation is contemned, and even if the external wound should have closed, which is not commonly the case, the fact of its being a spurious diffused aneurism, without a sufficiently restraining sac, is neglected. The unaccountable and absurd fear of hemorrhage on opening such a sac, after the numerous instances which are recorded proving its unworthiness, is only equalled by the no less strange and more unaccountable fear which still pervades the minds of many surgeons, of cutting through muscular fibres in order to expose an artery. These apprehensions are so truly ludicrous, that it appears to me almost incomprehensible, that they can have been so long entertained by able anatomists and surgeons. Nevertheless, they are the only reasons which can be given for placing a ligature on the internal iliac for a gluteal aneurism following a wound, or indeed on any other artery which has suffered a similar injury.

In order to make the necessity for abandoning all fear of hemorrhage from such aneurismal swellings manifest, and to show how imperative it is that even whole muscles should be divided, if they interfere in the progress of an operation, I shall first take into consideration wounds of the arteries of the hip and of the leg, and of the aneurismal swellings to which they may give rise.

Mr. J. Bell was the first to set the memorable example of dividing a large portion of a muscle to enable him to reach a wounded gluteal artery which he did not think he could attain by any other means. His vivid description of an incision of eight inches long, afterwards said to be enlarged to two feet (in what direction is not stated), the removal of eight pounds of coagulated blood from the sac, the deluge of fresh arterial blood which followed with a loud whizzing noise, after all which the patient recovered, ought to have allayed the apprehensions of the most timid surgeons; and although Mr. J. Bell's dramatic sketch of his leech catcher's case may be somewhat exaggerated, it ought to have made surgeons think more on these points than many appear to have done or even to do; and it should have induced them to perform such operations sooner, when the parts would be less distended, and more readily distinguishable.

This operation has since been done by Dr. Murray in Spain, Messrs. Rogers of the United States, Carmichael of Dublin, and Baroni of Bologna; and as the operations performed by the two last are as simply described as Mr. J. Bell's is fearfully related, I shall give them as shortly as possible.

Case 38.—Lieutenant Colonel M'Pherson, 92nd regiment, received a wound from a musket-ball on the 13th of December, 1813, which entered a little in front of the trochanter major of the left side, struck the os femoris which flattened it, passed underneath the glutæi muscles, along the ilium for about three inches, and lodged in the posterior part of the gluteus maximus, whence it was cut out next day. He continued to go on well and to recover his strength till the 27th of December, when he began to complain of pain and heat deeply seated in the wound, and was a little feverish and restless, for which he took a purgative and opiate at night, but without relief. On the 28th, the parts were observed to be more swollen, the pain was increased, and about noon a sudden and violent hemorrhage ensued from the posterior wound, by which in two or three minutes he lost upwards of two pints of blood. Compression was made on the mouth of the wound for some time, which restrained the flow of blood externally; but it appeared that hemorrhage was still going on internally. A firm hard compress of paper rolled up in a bandage was placed along the course of the posterior part of the wound, and bound tightly on it; the parts were kept very cool with vinegar and water; and gentle manual pressure, by a relief of servants as they became tired, was kept constantly on the pad, with a view to obliterate the artery. In the afternoon, a swelling about the size of an egg in extent, but not so thick, was observed to be forming below the pad, two inches from the orifice of the wound; he had for some time begun to feel a gradual increase of pain from the pressure, and whilst changing his posture in bed, the orderly removed his hand for a moment, when another gush of coagulated and of arterial blood escaped, which weakened but gave him ease.

29th.—The parts were considerably swelled, tense, and of a glased appearance about the centre of the course of the wound; and some blood forced its way out by the anterior orifice, to which an additional compress was applied. About four o'clock in the morning of the 31st, the pressure having been removed, as he was not able to endure it on account of the dreadful pain it gave him, another profuse hemorrhage took place; which reduced him so much that his extremities became quite cold, his countenance pale and shrunk, and his pulse was hardly to be felt. It was stopped as before. In the course of some hours he recovered his warmth, his pulse rose, he became tolerably hearty again and took some breakfast, but as it was evident that the bleeding was going on internally, at eleven, a.m., the operation for placing a ligature on the wounded vessel was performed by Staff-surgeon Murray. A large mass of coagulated blood forced its way out as soon as the incision was made, and was followed by florid arterial blood. The wound was immediately sponged out, and the pressure of two pads which had been placed on each side of the incision, having been removed a little, two large branches of the gluteal artery which had been cut in the first incision, presented themselves, and were secured. The parts were again cleaned out by a sponge; and in the course of the original wound, a large artery was found close upon the bone, from which all the secondary bleedings had taken place; it was included in a ligature, and all bleeding from that part entirely ceased. Its opposite orifice appeared to have been included in a second ligature, as the needle was passed nearly quite down to the ilium. Two other small muscular branches were afterwards taken up, and the lips of the wound then brought together by slips of sticking plaster, with a compress of lint on each side, and a flannel bandage to support the whole. Although he did not lose above four ounces of blood directly from the arteries by the operation, he became much exhausted before it was finished, and indeed we were not without some fears that he would have sunk during its performance. Fifty drops of laudanum were given to him, and he was left on his bed where the operation was performed. For some time he suffered from that anxious restlessness attendant on exhaustion and extreme debility, and from pain and irritation; but when by rest and a little nourishment the powers of the system began to recover from the shock, the equilibrium of the circulation to be restored, and the opium to exert its influence, he became very composed and easy; his pulse got up; his countenance recovered a degree of vivacity; he said he felt himself much better than before the operation, being more free from pain in the seat of the wound, and his mind was more at ease from the idea of the vessel having been secured; he got a tolerably refreshing sleep of three or four hours, interrupted only at intervals by starting.

January 1st, 1814.—He passed a tolerably easy night, slept at intervals, and took a little nourishment, but had also symptoms of great exhaustion with alternations of chills and flushings, and clammy perspirations, and now and then sickness and hiccough. The parts about the wound were comparatively easy, but hot; there was no oozing of blood; he took a mouthful of toast with a dish of tea to breakfast, was in good spirits, but inclined to doze and sleep much. During the day his appetite failed. Towards evening he began to sink very rapidly, and died at eleven o'clock, p.m.

*Remarks.*—On examining the state of the parts after death, it was found that no adhesion had taken place. It is evident that the operation ought to have been done in the first instance. The only cause of delay arose from the thickness of the muscular parts to be divided, and the dread which at that period filled the minds of most surgeons upon this subject—a dread which it is to be hoped will be for the future abandoned.

Case 39, by Mr. Carmichael.—Master West, aged seventeen, eleven days before my visit received accidentally a wound of a penknife on the right hip, which penetrated as far as the handle would permit it to go. An immediate gush of blood followed, so strong as to dash against the wall of the chamber near to which he was sitting. Three days afterwards the patient imprudently walked down stairs, but had scarcely returned to his room when he felt an acute pain in the hip, followed by an immediate tumefaction, which increased from day to day. The small cicatrix of the wound was situated about half an inch above the presumed situation of the upper margin of the ischiatic notch, where the gluteal artery emerges from the pelvis. No pulsation was evident to the eye, even on the most minute examination, but the strong pulsation of an aneurismal tumour was manifested to the ear, either by immediate or mediate ascultation. It was evident, therefore, that the tumefaction of the hip did not depend upon the presence of matter, notwithstanding the patient had been affected with frequent rigors from the period that the swelling took place, accompanied by a foul tongue and symptomatic fever; but that it was owing to an effusion of blood in consequence of a wound of the trunk of the gluteal artery, or one of its largest branches.

As I had known instances of wounds of large arteries healing under similar circumstances, although the limb was injected with blood, I deemed it right to give this patient a similar chance before recourse was had to operation. I therefore directed ten ounces of blood to be taken from his arm, as the tumour was painful, and the pulse quick and hard. Draughts containing tincture of digitalis were given every sixth hour; a cold lotion was applied to the tumefied parts, and absolute rest in the recumbent position enjoined. This plan, with occasional opiates to meet pain and uneasiness, was persevered in during five days, but no benefit was derived. On the contrary, the tumefaction of the hip and entire limb was obviously increasing, and an operation was necessary. The patient being placed upon a table, lying on his face, I commenced by making an incision five inches in length, beginning an inch below the superior posterior spinous process of the ilium, and about the same distance from the margin of the sacrum, and continued it in a line extending obliquely downwards to the trochanter major. The gluteus maximus and medius were then rapidly divided, or rather their fibres separated (as the incision ran in the direction of the fibres), to the same extent as that of the integuments. The coagulated blood forming the tumour then became apparent through the sac or condensed cellular membrane with which it was covered. This was divided the whole extent of the incision by running a buttoned bistoury quickly along the finger introduced into the sac, and its contents, consisting of from one to two pounds of coagulated blood, were emptied rapidly out with both hands into a soup plate, which it completely filled. A large jet of fresh blood instantly filled the cavity I had emptied; but the precise spot from whence it came being perceived, I was enabled by pressure with the finger, to prevent any further effusion, while that which had been just poured out was removed by the sponge. It was obviously the trunk of the gluteal artery, just as it debouches from the ischiatic notch, which had been wounded. I endeavoured, but in vain, to secure the artery by means of the tenaculum. I had then recourse to a common needle of large size, and with this instrument was immediately successful in passing a ligature around the bleeding vessel, and in preventing all farther hemorrhage. After having waited some little time to ascertain if the artery was perfectly secured, lint was introduced to the bottom of the wound, as it was not likely that union by the first intention would take place between the walls of the extensive cavity which contained the coagulated blood. The patient was then put to bed, and an anodyne given to him. Everything went on favourably after the operation. On the third day the external dressings were removed; on the fourth the greater part of the lint with which the wound was filled came away, followed by a flow of matter of a good quality. On the sixth the ligature came away as well as the remainder of the lint. From this period the matter continued daily to diminish, and the patient recovered.

Case 40.—Professor Baroni, of Bologna, was called to a young man who was wounded in the right hip by a fall from a tree on his own pruning-hook, which divided the glutæi muscles, laying bare the sacro-sciatic ligaments and the bone. The edges of the wound united, but an abscess formed, requiring to be evacuated. The fourteenth day after the accident two most serious hemorrhages took place, which were restrained by compression. The wound being laid open, and the coagula removed, a jet of arterial blood marked the situation of the gluteal artery, the upper end of which was tied by the professor; but as the bleeding continued from the opposite end, a ligature was also placed on it, and the man recovered in a month.—*Gazette Médicale*, p. 695, 1835.

*Remarks.*—These cases are quite decisive as to the practice which ought to be pursued in wounds of the gluteal or of the sciatic arteries, or in aneurismal tumours, the consequence of wounds, in preference to placing the ligature on the internal iliac artery, as in a case of aneurism formed from disease of the coats of the vessel; to which operation, in such cases, the only real objections are, that the patient is likely to suffer from peritoneal inflammation, and that the operation is one of some difficulty, requiring a great degree of dexterity, and of anatomical knowledge.

The Baron Dupuytren in 1828 published a paper entitled "Memoire sur les Aneurismes qui compliquent les fractures et les plaies d'armes à feu et sur leur traitement par la ligature pratiquée suivant la methode d'Anel," in the *Repertoire General d'Anatomie et de Physiologie*, which operation he recommended as superseding that of amputation, which, up to that time, he says, had been usually performed in France in such cases, and with the view of avoiding the operation I had proposed some years before on the part injured, by cutting through the intervening muscular fibres. The operation the baron did was that of Hunter, and not, as he states, that recommended by Anel, who never performed one on that principle. A strange error for the baron to have fallen into, but no less so than the statement made at page 22 that he had consulted in vain both ancient and modern authors on this subject, although Breschet had translated Mr. Hodgson's work on the Diseases of Arteries nine years before, in which my earliest cases were especially noticed. His memoir shows, at all events, that the practice the Baron Dupuytren recommended to the surgeons of France in 1828 as worthy of their adoption, had been tried by many of the surgeons of the British army in 1811 and 1812, and found wanting, and is an honourable testimony to their labours. The baron supports his views by the relation of seven cases, which I have transcribed in my work on this subject, although two only bear effectually upon it. One is by Delpech, the other by himself. In Delpech's case (No. 41) the patient, Jacques Boudet, thirty years of age, had his left leg broken (a comminuted fracture) on the 8th of May, 1815, by the wheel of a car laden with hay. On his arrival at the Hospital St. Eloi, M. Delpech found the limb enormously swollen, and this swelling was accompanied by pulsations, which were very distinct near the calf, and more or less perceptible when pressure was made on or removed from the above artery. The femoral artery was tied next day, and the patient recovered, and was discharged cured on the eighty-second day.

*Remarks.*—In this case it was not known whether the anterior or the posterior tibial artery was wounded, or the femoral, or all three, or the popliteal alone. An incision made, even in the right place, must have made a comminuted fracture a compound one, and greatly endangered the life of the patient. The operation was therefore a fair experiment, and if it failed, amputation was still a resource before mortification had taken place. It is not exactly a case in point.

The baron's seventh case, that of Captain de Gambaud, fairly however meets every point, and as far as it goes fully establishes his opinion.

CASE 42.—"M. de Gambaud received, February 10th, 1818, a wound from a horse pistol, which entered the upper part of the right leg, from the front backwards, and from the outside inwards, passing between the tibia and the fibula, which latter it slightly injured. A violent bleeding immediately ensued. A young surgeon stopped the hemorrhage by the application of a compress and bandage. The leg became swollen and very painful, to which succeeded an alarming numbness; nevertheless life remained in the limb, and no outward bleeding occurred till the thirteenth day; but during this time an internal effusion had taken place, and an aneurism was developed, which increased every day, and became more observable from its synchronous movements of expansion and contraction with those of the pulse.

"The bleeding was renewed several times in a few days, and greatly weakened the patient, in spite of the assistance, both internal and external, which was afforded him. The foot and leg were of a violet colour, swollen, cold, and numb. On the upper part of the leg there was a swelling accompanied by tension, and a movement of expansion and contraction, synchronous with the action of the heart. There were two small round openings with unequal edges on this tumour, situated the one at the back of the leg near the fibula, the other on the inner edge of the calf. The first was where the ball entered, and the second where it came out. They both for a few hours had been closed by clots of blood, that each pulsation threatened to raise and force out. A tourniquet applied to the lower part of the thigh on the course of the femoral artery, would of course lessen the impulse of the blood, but could not prevent its getting to the tumour, and giving rise to frightful shocks.

"Such was M. de Gambaud's state; the wound that he had received, the first hemorrhage that he had sustained, the tumour which had been formed from the first moment that the blood had ceased to flow outwardly, the volume and tension of this tumour, the nature, extent, and strength of its movements, the repeated bleedings that the patient had suffered, all proved that the ball had destroyed one or several of the great arterial trunks in the ham.

"What was to be done? We could not again make use of compression, which had already been fairly tried, and had not prevented five or six hemorrhages taking place, which had reduced the patient to an alarming state of weakness. Ought we to place a ligature on the extremities of the divided vessels?

"But what were those vessels? Was it the anterior or posterior tibial artery, or the peroneal, or the popliteal artery, or was it several of these at the same time? If it were one or more, how should we attack them, before or behind, or on these two points successively?

"But to all who know the depth at which these vessels are situated, their relation to the bones, muscles, and nerves, this project appears impracticable. Could we even determine exactly, which was impossible, which vessel was injured, how could we get at it? How could we distinguish it from the soft, torn, and bruised parts which would surround it? or how would the instruments and the threads necessary to tie a ligature be got to the bottom of a wound thus deep, and between the bones? The amputation of the thigh seemed the most prompt and safe remedy; and this was what my young colleagues wished, and only waited for my sanction to perform. Amputation is not, however, without danger, and in my opinion will kill three out of twelve, when practised even upon young and healthy persons, such as are chosen for its victims on the field of battle. I did not therefore recommend that it should be had recourse to, but advised the placing of a ligature on the femoral artery. If the event did not turn out as I expected, if the blood brought back by the collateral arteries continued to flow either at the superior or inferior extremity of the divided artery, or if from any other cause the ligature should prove insufficient, it would become the first part of an amputation, neither more dangerous nor more painful from being performed at two intervals. The operation was performed in one minute. It proved successful, and M. de Gambaud was quite cured in three months."

To support his opinion that this case should lead the way towards erecting the practice pursued into a precept in surgery, he is forced to consider certain points as facts, which have never been demonstrated to be facts; but I shall give his own words:—

"The ligature, in suspending the course of the blood in a divided vessel, the solution of continuity of which has caused an external and internal bleeding, gave time and means to the inflammation to cicatrise the wounds in the vessel, and to render the cut extremities impermeable to the blood which the anastomosing branches might bring to them.

"To judge by analogy, this obliteration ought to be more easy and more certain after a gunshot wound than any other.

"One of their most remarkable effects is to contract (*froncer*) the orifices of the vessels, to concrete or coagulate the blood contained in their extremities, and to render them impervious."

*Remarks.*—This last passage cannot be admitted as a correct statement of the effects of a gunshot wound on arteries.

I have shown in the preceding observations the real effect of a ball on the extremity of a divided artery, and that the appearances depend very much on the size and structure of the vessel. In what manner the ball can contract (*froncer*) the orifices of an artery has never been shown, neither can it be easily understood, inasmuch as the act of contracting must be a vital act dependant on the powers of the artery itself. If it be a mechanical act, arising from injury, it must be a contusion; and this cannot be advanced as a process likely to consolidate the end of the vessel, it being now well known that the first and most simple state of adhesive inflammation is the best calculated for promoting the permanent closure of a divided artery.

When a wounded artery has been tied at a distance from the wound, as in the case of M. Dupuytren, it is certainly true that if the blood can be prevented by this means from passing into the divided vessel, there will be a greater chance of the natural processes of inflammation and granulation which are taking place in and around it, closing it up, than if the blood be allowed to flow through it. But it is only then a chance. It is impossible to calculate the time which nature may require to bring the blood by the collateral vessels into either the upper or the lower end of the vessel; it may occur immediately; it may not do so for hours or for days, and on the speculation that it may not do so, the first hope of safety depends—the second on the further accidental circumstance that the end of the artery may be closed in the interval. Surely this cannot be considered a scientific operation, and fit to be erected into a precept in surgery, which depends on two accidental circumstances, neither of which can in the slightest degree be calculated upon.

There are many other reasons why the operation was a bad one in this case, and always will be a bad one in all similar cases. The patient was made to undergo the chance of mortification of the extremity, which it is probable would have taken place, if the operation had not been delayed until thirteen days after the first hemorrhage occurred from the wound, during which time the inflammation in the limb had given the collateral vessels a disposition to enlarge. The wound itself was not treated as the principles of surgery require. A quantity of decomposed blood was pent up under and between the muscles of the calf of the leg, together with some of the patient's clothes, and some spiculæ of bone. In a case like this, unattended by the fear of hemorrhage, the baron would have enlarged the wound, cleared away the clots of blood, and have placed it in a simple state. There cannot be a doubt on the subject, and the operation of making an incision through the muscles of the calf of the leg would have enabled him to do all this, and to have secured the vessels, if there had been even four bleeding extremities, without any difficulty or danger.

The Baron Dupuytren applied Mr. Hunter's theory of the operation for aneurism to the treatment of a wounded artery, and succeeded by chance. Others have done the same long before him; but nothing which is dependent on chance or accident can ever become a principle in surgery, and I understand the baron became so thoroughly convinced of this before his death, that he at last advocated the principle that a wounded artery should be tied at the injured part, and not at a distance, in opposition to the then generally received opinions in France.

Case 43.—A gentleman was thrown from the top of a coach at Chatham, and suffered a severe injury of the thigh, which broke the bone. No further injury was suspected, until a tumor formed at the lower and internal part of the thigh, and the toes began to turn black and to mortify. My opinion was now desired, and my reply was, amputate the limb, or you will lose your patient by the extension of the mortification, which eventually occurred.

*Remarks.*—If the mortification had not taken place, the surgeon could with propriety have awaited the progress of the diffused aneurism, there being no external wound. If it continued, and remained stationary, or only slowly increased during weeks, the operation for its cure by ligature of the artery above would have been a fair experiment. If, on the contrary, the aneurismal swelling increased rapidly, or the consolidation of the fracture did not take place, amputation was the safest resource.

Case 44.—A man was admitted into the Westminster Hospital, under the care of Sir Anthony Carlisle, having had a beating tumour in his ham, which had suddenly disappeared on something apparently giving way in his leg, which caused it to swell to nearly double the size of the other, from immediately below the knee to the ankle. There was no doubt in my mind of its being a diffused aneurismal swelling from rupture of an aneurismal sac, and I suggested the propriety of placing a ligature on the femoral artery, as for an ordinary aneurism, and awaiting events; such as laying open the soft parts of the leg for the evacuation of the coagulated blood, or of the matter which might form, or to make the ligature of the artery the point of amputation, if gangrene should supervene. Sir Anthony Carlisle preferred laying open the leg at once; this he did by an incision through the calf of the leg, opening into a largely dilated and ruptured sac, formed at the origin of the posterior tibial artery. The coagula being removed, the popliteal artery bled vigorously; the anterior tibial opening into the sac did the same, and the lower end of the posterior tibial poured out arterial blood even more vigorously than the anterior tibial. Sir Anthony Carlisle decided on amputating the limb, which he did, and the patient died.

*Remarks.*—If this diffused aneurismal swelling had followed a wound inflicted some two or three weeks before, the three bleeding arteries and the effused blood would not have rendered amputation admissible unless mortification supervened. It was the previously diseased state of the artery which had led to the formation of the aneurism that induced me to recommend that it should be tied in the thigh as an experiment, and after the diseased artery with its sac, &c., had been laid open, that the limb should be amputated.

Case 45.—Sir Astley Cooper at one time shared in the same opinion as Dupuytren, and tied the femoral artery for a wound in the leg below the knee. Mr. Green, who was present, informs me that the bleeding returned, and the limb was amputated, and Sir Astley, I know, abandoned both the theory and the practice.

Case 46.—Mr. S. Cooper did the same thing at Brussels after the battle of Waterloo, and succeeded; but he admits in his Dictionary, article "Arteries," that he succeeded only because the collateral branches did not re-establish the circulation in the lower end of the artery, or that it had been closed in time to prevent it when they had done so. This was an operation successful by chance, and not on principle. Mr. S. Cooper did better in 1834, in the following:—

Case 47.—The man had a wound in the calf of the leg, and the house-surgeon of University College Hospital having failed after several trials to secure effectually the wounded artery, he (Mr. Cooper) tied the popliteal, and succeeded. In this case he descended from Hunter to Anel, but this also only succeeded by accident, and another operation would have been required if the collateral circulation had been early restored, whereas a single straight incision through the muscles of the calf would have enabled him to tie all the cut vessels, even including the popliteal, or principal trunk. I am quite satisfied that if another case of the kind should occur to the learned professor of surgery, he would tie the artery above and below the part injured, and by the operation I shall show you has succeeded so well.

Case 48, by Mr. Stanley.—A butcher in slaying an ox received a wound on the inner side of, and about two-thirds down the leg; the length of the wound was not more than half an inch, but it penetrated from the inner almost to the outer side of the leg, and deeply in the direction of the posterior tibial and peroneal arteries. Profuse arterial bleeding immediately ensued. A bandage was placed around the leg, which was not disturbed for eight days; then, on removing it, the hemorrhage returned. He freely enlarged the wound, and exposed the posterior tibial artery, which was of unusually small size, and was partially divided. He placed two ligatures around the artery, one above and the other below the wound in it.

Much constitutional derangement followed, with inflammation of the absorbents up the thigh. This was succeeded by an attack of delirium tremens, from which the man sunk on the fifteenth day from the receipt of the wound; but there was no return of bleeding after the ligature of the posterior tibial artery.

On examining the limb, the posterior tibial artery throughout was found to be not more than half its usual size. The peroneal artery in its whole length was more than twice the size of the posterior tibial. It was found that the knife in its passage through the leg, having partially divided the small posterior tibial artery, had also penetrated the large peroneal artery at a point where it was very deeply situated, in a hollow between the fibula and the inter-osseous ligament, but which had not bled.

Case 49, by Mr. Stanley.—A boy, ten years of age, in walking, slipped his foot through a pane of glass, which wounded the inner side of the leg in the hollow between the inner malleolus and os calcis. Profuse bleeding immediately ensued, which was stopped by a bandage. Three days afterwards the removal of the bandage was followed by a flow of arterial blood. He enlarged the wound, exposed the posterior tibial artery, and observed a hole in the side of it, from which the blood issued. He placed two ligatures around the artery, about an inch distant from each other, the one clearly above, the other below the orifice in the vessel. About an hour afterwards the arterial bleeding returned, and on sponging out the wound, to his surprise, he found that the blood escaped from the hole in the side of the artery. He then placed two additional ligatures around the artery close to the hole in it. There was no return of the hemorrhage.

*Remarks.*—It was presumed that a branch had conveyed the blood into the artery in the interspace of the two ligatures which were first applied. This case is most valuable and important.

The following case was published by me in the 7th vol. of the "Transactions of the Medico-Chirurgical Society":—

Case 50.—Henry Vigarelie, a private in the German legion, was wounded on the 18th of June, at the battle of Waterloo, by a musket ball, which entered the right leg immediately behind and below the inner head of the tibia, inclining downwards, and under or before a part of the soleus and gastrocnemius muscles, and coming out through them, four inches and three quarters below the head of the fibula, nearly in the middle, but towards the side of the calf of the leg. In this course it is evident that the ball must have passed close to the posterior tibial and peroneal arteries; but as little inflammation followed, and no immediate hemorrhage, it was considered to be one of the slighter cases. On the latter days of June he occasionally lost a little blood from the wound, and on the 1st of July a considerable hemorrhage took place, which as suppressed by the tourniquet, and did not immediately recur on its removal. It bled however at intervals during the night; and on the morning of the 2nd it became necessary to re-apply the tourniquet, and to adopt some means for his permanent relief.

The man had lost a large quantity of blood from the whole of the bleedings, his pulse was 110, the skin hot, tongue furred, with great anxiety of countenance: the limb, from the application of the tourniquet from time to time, was swelled, a quantity of coagulated blood had forced itself under the soleus in the course of the muscles, increasing the size of the leg, and florid blood issued from both openings on taking the compression off the femoral artery. On passing the finger into the outer opening, and pressing it against the fibula, a sort of aneurismal tumour could be felt under it, and the hemorrhage ceased, indicating that the peroneal artery was in all probability the only vessel wounded.

In this case there was, in addition to the wound of the artery, a quantity of blood between the muscles, which in gun-shot wounds accompanied by inflammation is always a dangerous occurrence, as it terminates in profuse suppuration of the containing parts, and frequently in gangrene. Its evacuation therefore became an important consideration, even if the hemorrhage had ceased spontaneously.

The man being laid on his face, with the calf of the leg uppermost, I made an incision about seven inches in length in the axis of the limb, taking the shot hole nearly as a central point, and carried it by successive strokes through the gastrocnemius and soleus muscles towards the peroneal artery, which I attempted to discover, but this was more difficult than might be supposed, after such an opening had been made. The parts were not easily separated, from the inflammation that had taken place, and those in the immediate track of the ball were in the different stages from sphacelus to a state of health, as the ball in its course had produced its effect upon them, or their powers of life were equal or unequal to the injury sustained.

The sloughing matter mixed with coagulated blood readily yielded to the back of the knife, but was not easily dissected out. The spot which the arterial blood came from was distinguished through it, but the artery could not be perceived, the swelling and the depth of the wound rendering any operation on it difficult. To obviate this inconvenience, I made a transverse incision outwards, from the shot hole to the edge of the fibula, which enabled me to turn back two little flaps, and gave greater facility in the use of my instruments. I could now pass a tenaculum under the spot whence the blood came, which I raised a little with it, but could not distinctly see the wounded artery in the altered state of parts, so as to secure it separately. I therefore passed a small needle, bearing two threads, a sufficient distance above the tenaculum to induce me to believe it was in sound parts, but including very little in the ligature, when the hemorrhage ceased; another was passed in the same manner below, and the tenaculum withdrawn. The coagula under the muscles were removed, the cavity washed out by a stream of warm water injected through the external opening, the wound gently drawn together by two or three straps of adhesive plaster, and the limb enveloped in cloths constantly wetted with cold water. The patient was placed on milk diet.

On the 4th, two days after the operation, the wound was dressed and looked very well; the weather being very hot, two straps of plaster only were applied to prevent the parts separating. On the 5th, a poultice was laid over the dressings, in lieu of the cold water, the stiffness becoming disagreeable. On the 6th, as the wound, although open in all its extent, did not appear likely to separate more, the plasters were omitted, and a poultice alone applied. On the 8th and 9th it suppurated kindly; and on the 10th, or eight days from the operation, the ligatures came away, the limb being free from tension, and the patient in an amended state of health, his medical treatment having been steadily attended to.

From this period the cure went on, although slowly, without accident; a small abscess formed at the inner and lower edge of the soleus muscle, but closed shortly after its contents were evacuated. The wound was entirely healed in three months, but the leg was bent on the thigh, and required mechanical means for its extension.

The length of the fibula is sixteen inches. The cicatrix of the wound made by the ball is four inches and three quarters below the head of the fibula. The sound limb, four inches and three quarters from the head of the fibula, is thirteen inches and three quarters in circumference. The limb operated on eleven inches and three quarters, being a diminution of two inches. The length of the cicatrix is six inches and a half. The peroneal artery was tied therefore by computation one inch and a quarter below where it is usually given off by the posterior tibial.

The man was brought to England to the York Hospital at Chelsea, and walked about without appearing lame, although he could not do so for any great distance. He suffered no pain, except an occasional cramp in the ball of the foot, and some contraction of the toes, which took place generally when he rose in a morning, and continued for a minute or two, until he put them straight with his hand; this I did not attribute to the operation, but to some additional injury done to the nerves by the ball in its course through the leg.

Mr. Hall, of East Retford, has published the following case in the *London Medical Gazette*, of the 6th February, 1846:—

Case 51.—April 16, 1841. A gentleman, upwards of sixty, had been thrown from his horse, and was reported to be bleeding to death from a wound of the leg. In less than half an hour after the infliction of the injury, his clothes were saturated with blood, and a considerable quantity had flowed into his shoe. He was cold and faint, with a feeble pulse. A little brandy and water were immediately given to him, and he was placed in bed. On removing his clothes, a wound of about an inch in length was seen in the calf, a little below the junction of the upper with the middle third, and from which the blood was now again beginning to flow freely. A tourniquet was applied over the femoral artery, which retarded the hemorrhage, but did not altogether check it. The nature of the injury was at once evident, and the necessary steps immediately taken for securing the posterior tibial artery. Introducing a long narrow bladed knife into the wound, the muscles were carefully divided above and below the seat of injury, down to the deep fascia, which was clearly seen on sponging away the coagulated blood, and into which a small opening had been made. The manner in which the injury had been sustained was doubtful. When it occurred, the old gentleman was riding a horse that plunged violently, and threw him with great force to the ground; his foot was fixed in the stirrups, and he was dragged some distance; he says, when his foot got at liberty, the horse kicked him with considerable violence on the leg; he had neither trousers nor gaiters upon his leg, which was only protected by a thick stocking. On looking at the shoes of the horse, it was found he had been shod behind with what are called "caulkings," one of which it is supposed had been driven into his leg. The opening in the fascia was enlarged, and, after removing a good deal of coagulated blood, the artery was found, and secured by passing a ligature above and below the wound, the vessel was divided between them. The wound in the muscles was then brought together, and a bandage applied from the toes to the upper part of the thigh; the patient appeared to experience much relief from this, which in a great measure checked the spasm and quivering of the muscles, which was somewhat severe during and immediately after the operation. A large dose of liq. opii. sed. was given. No constitutional disturbance worthy of notice took place. Both ligatures came away on the 12th day after the operation. Mr. Hall saw this gentleman some time afterwards; he was on horseback, and told him he could not discover that the leg on which the injury was sustained was worse than the other; and that it did its work very well.

Case 52.—A robust young man was admitted into the Middlesex Hospital on January 1, 1845, with a punctured wound from a joiner's chisel in the calf, at the junction of the upper with the middle third of the leg, and a little to the inner side of the mesial line. Arterial and venous blood flowed in quantity. From the situation, depth, and direction of the wound, as ascertained by a probe, it was evident that the posterior tibial was probably wounded. Mr. Arnott determined to cut down upon it at once, in order to secure both ends. For this purpose, taking the punctured wound as a centre, he made an incision through the skin and muscles of the calf, to the extent of six and a half inches; the deep fascia being thereby exposed, the opening in it made by the chisel was enlarged to the extent of two inches. After considerable difficulty from the bleeding, it was ascertained, that besides the wound in the posterior tibial, both venæ comites were divided. On account of the troublesome character of the bleeding from these veins, and the difficulty created in discovering the artery, one of the veins had a ligature placed on both ends, whilst the lower end of the other was subjected to pressure. Two ligatures were then placed on the artery, one above and the other below the puncture; it was not till the latter was tied that the hemorrhage ceased. Little febrile disturbance followed the operation; the lower ligature on the artery came away on the eighth day, the upper on the ninth. During the night of the eleventh, some bleeding took place from the lower angle of the wound, which was not arrested by compression of the femoral artery, but which was easily checked by displacing some coagula from the wound, and making pressure at the lower part of it by means of a small compress of lint, which was left in the wound. This was removed in three days, and the case proceeded subsequently uninterruptedly to a favourable termination. The wound cicatrised in less than two months, and the patient recovered with a perfectly efficient limb.

Case 53.—John Sullivan, 27th regiment, had his leg amputated six inches below the knee, at Tarragona, in April, 1833, by Staff-surgeon Roche, in consequence of a compound fracture and dislocation of the ankle-joint. Three days afterwards hemorrhage took place, and a small aneurismal tumour about the size of a pigeon's egg was discovered bleeding about an inch above where the ligature had been applied. This part of the calf was laid open, and a ligature applied midway between the sac and the origin of the artery from the popliteal. It succeeded, and was the operation of Anel, justly preferred to that of Hunter, because there was an open stump with which the little aneurism was continuous.

Case 54.—Jean Debret, a French prisoner of war, came under the care of Staff-surgeon Collier, in the beginning of September, having been wounded at the battle of Waterloo by a musket ball, which broke both bones of the left leg, and required several incisions to be made into the soft parts, which were greatly implicated by disease. He had suffered an attack of erysipelas, and the constitution had sympathised greatly with the injury, and was little able to resist it. Towards the end of the month the wound assumed the character of the hospital sore or gangrene, which spread rapidly over all the parts down to the tibia. The extensor tendons were dissected bare for the space of four inches, and the interosseous membrane even appeared to have partaken of the disease. On the 4th of October hemorrhage took place about two inches and a half above the ankle-joint, which was arrested by pressure. On removing this and some coagula which covered the artery, it bled furiously; a little dissection laid the artery bare an inch and a half above this spot, where a ligature was passed around it, and the bleeding never returned. The ligature came away on the sixth day, and the man recovered, and was sent to France with a serviceable leg, although lame.

Several of our best anatomists, in order to avoid the operation I have recommended, which Messrs. Hall and Arnott have so well performed, and which renders the division of the great muscles in the calf of the leg necessary, advise a tedious and more difficult operation to secure either the posterior tibial or the peroneal artery; and as a mistake may be made as to which is divided, when the wounding instrument has passed from side to side, and blood flows freely from both orifices, they further advise that one should be tied first, and if not successful, that a second operation should be done to expose the other, instead of doing my operation at once, and thereby enabling the operator to place a ligature on either, or on both.

The operation of tying the posterior tibial artery in the middle of the leg, after the ordinary methods recommended, is not very easily accomplished. It is said the leg should be bent, the foot extended, and both placed on the outer side; an incision should then be made, about four inches in length, along the inner edge of the tibia, through the integuments and fascia (the internal saphena vein should be avoided), when the edge of the gastrocnemius muscle will be exposed, which may be easily raised and drawn to the outer side; a director should then be insinuated beneath the head of the soleus, on which this muscle must be divided from its attachment to the tibia; the deep fascia of the leg will then be seen very tense and strong, binding down the deep-seated muscles and the tibial nerve and vessels; this must be cautiously divided on the director passed beneath it. The foot should then be extended as much as possible, and the knee placed in the flexed position, to relax the superficial muscles on the back part of the leg, when the artery may be felt pulsating about an inch from the edge of the tibia; the veins are then to be separated from the artery with a blunt instrument, and the aneurism needle passed round the latter in a direction from without inwards, so as to avoid the posterior tibial nerve.

On the dead subject this operation is not attended with much difficulty; in the living however the case is very different: the muscles are then rigid and unyielding, and when the fascia which covers them is divided, they leave their natural situation and become much elevated, so as to make the situation of the artery appear as a deep cavity, at the bottom of which the vessel is placed. Add to this that the artery is cut across, has retracted upwards and downwards, that both ends may not bleed and cannot be found in the small space which has been made, although both require to be tied; add to this that the surgeon may have made a mistake, and finds that it was the other and more distant artery that is wounded, or that both are injured, and the operator will be in a very unenviable condition.

Let us proceed however with the simple case. The operator has cut his four inches, has turned up the edge of the gastrocnemius, and has insinuated his director under the head of the soleus, which he has also sliced away from the bone. The artery is still an inch inwards, bound down by a strong fascia; pulsating it is said, bleeding I say if it pulsates, all this time as fast as it can, or else a tourniquet has been applied, and the pulsation has been suspended. The fascia must be cut immediately over or by the side of the artery; it will not do to separate it from the bone, and then push it over; it cannot be done, and would not do if it could. The artery must then be allowed to bleed. The tourniquet must be unscrewed, and the wound is immediately filled with blood. Nothing can be done until this is sponged out, and to enable this to be done, the tourniquet must be screwed up, and then the surgeon is pretty much where he was before. We will suppose that he has succeeded in dividing the fascia, for an inch at least in extent, over the artery, without injuring it or anything else. What is directed to be done next? Why certain evolutions are to be performed with the leg, as described above, and then the surgeon is to separate the two veins from the artery with a blunt instrument, and then he is to pass an aneurismal needle under the artery from without inwards, so as to avoid the nerve. Now all this is to be done in a hole, the bottom of which the operator can scarcely see, and if he could it would not signify, because it is on the side of the bottom of the hole he is to perform these different evolutions on parts too likely to be covered continually with blood; for although the bleeding from the upper end of the artery may be suppressed by the tourniquet, that from the lower end in young persons may not; and at all events the unscrewing of the tourniquet will cause a most troublesome oozing, occupy a great deal of time, and give rise to much pain. Lastly, when the operator comes to the fascia, he will find his first four inches will not give him room enough; if he succeeds in dividing it, and tries to find the artery, the deficiency of space will cause him to enlarge his first incision; and before he has completed his operation, the quantity of cutting, retracting, pulling, sponging, and bleeding will make it to himself a most unsatisfactory operation. Of the patient's sufferings we will say nothing. If a bystander should inquire, why this most painful, difficult, bloody, tedious, and dangerous operation (dangerous from the chance of failure) is done?—the answer would be, solely because it is not usual to make a longitudinal incision in the muscles of the calf of the leg; an incision which if made by accident would be pronounced to be one attended with little danger, and not likely to lead to any subsequent detriment. Let us compare this operose proceeding with the following simple operation:—

An incision is to be made six or seven inches in length, by successive and rapid incisions, through the integuments and muscles of the calf of the leg down to the fascia. The centre of the incision is to be on a line with the holes made by the wounding instruments, or if they are diagonal to each other, between them; and it may be either directly in the middle of the calf, or a little to the side of, or directly over the artery supposed to be wounded: it is not material which. The smoothness of the fascia points it out, and the loose cellular membrane connecting the divided muscles to it, allows of the edges of the long incision being easily separated, and to such a distance as to admit of the exposure not only of the posterior tibial artery, its two veins, and the nerve, in as distinct a manner as any other arteries, veins, and nerves, can be exposed in the human body, but of the peroneal artery also. The tourniquet is then to be unscrewed, and the bleeding, if the wound did not bleed before, leads to the spot where the artery is injured. The artery may be laid bare in its whole extent by as common a piece of dissection as any ever practised, and nothing can interrupt the application of the ligature to either or both vessels, if they should be wounded. The nerve, the veins, and the fascia cease to be surgical bugbears, and the operation is as simple as any in surgery. No surgeon or anatomist can dispute this statement. Mr. Hamilton, M. Berard, and others, have also successfully treated wounds in the lower part of the posterior tibial artery in this way, and a careful consideration of the cases related, and the facts and arguments advanced, must, I am satisfied, cause every surgeon to conclude that there is only one right way of treating wounded arteries in the leg.

My kind friend, Mr. Carmichael, of Dublin, at the conclusion of his case No. 39, reproaches me with having said, "In all cases of aneurism of the gluteal and sciatic arteries, the internal iliac should be tied, instead of an operation on the part itself." He admits he is aware that I do not mean this sentence to apply to aneurismal tumours, the consequence of wounds, but only to aneurisms formed after injury of the artery. It was however, he says, quoted against him as an authority in his case which I have transcribed, and he is therefore desirous that all ambiguity on this point should be removed, that I should on all future occasions explicitly declare that all wounded arteries, and all aneurismal swellings of recent date occurring after wounds of arteries, are to be treated by ligatures of the artery at the wounded part. He desires that I should do this in such manner as to remove all doubt on the subject. I now comply with this desire in the plainest possible manner, and declare that any other mode of proceeding is contrary to those principles which ought to guide the surgeon not only in all such cases, but in all others in which it can by any possibility be applied.

# LECTURE IV.

*Wounds and injuries of the axillary artery; Results of ligature of the subclavian artery; Great fatality of the operation; Mr. Keate's case of ligature of the subclavian, below the clavicle, for axillary aneurism, following a gun-shot wound; Mr. Chamberlaine's case of ligature of the subclavian, below the clavicle, for axillary aneurism, the result of a wound from a cutlass; Case of immediately fatal wound of the axillary artery from a musket-ball; Case of sabre-cut, dividing the pectoral muscle; Case of wound of the axillary artery, and ligature of the injured vessel; Delpech's case of wound and ligature of the brachial artery, followed by secondary hemorrhage from the irritation caused by the ligature* d'attente*; ligature of the axillary or subclavian, suppuration under the pectoralis major, and death; M. Galtié's case of ligature of the subclavian above the clavicle, for secondary hemorrhage after amputation at the shoulder-joint; Treatment of hospital gangrene by the actual and potential cautery; Larrey's case of presumed wound of the subclavian artery and vein; recovery without operation; Delpech's case of wound of the carotid; recovery without operation; Elasticity and resistance of arteries to injuries; Larrey's case of sword-wound of the ulnar artery, cured by compression; formation of an aneurism; ligature of the brachial, opening of the aneurismal sac, and ligature of the interosseous artery; Catanoso's case of wound of the axillary artery; ligature of the subclavian below the clavicle; extensive suppuration; enlargement of the wound, and treatment by compression; Montanini's case of ligature of the axillary for false aneurism caused by a wound; Dupuytren's case of ligature of the subclavian, above the clavicle, for an aneurism of the axillary artery following a wound; Lallemand's case of ligature of the subclavian, above the clavicle, for diffused aneurism of the axillary artery following a wound of that vessel; extensive suppuration of the sac; Professor Blasius' case of wound of the arm-pit by a sword; ligature of the subclavian, terminating fatally; Dr. Monteath's case of ligature of the axillary artery for diffused aneurism, the result of an injury; Messrs. Maunoir's case of ligature of the wounded axillary artery; Desault's case of ligature of the wounded axillary artery; Dr. Segond's case of ligature of the subclavian above the clavicle for a wound of the axillary artery; Dr. Nott's case of ligature of the subclavian, above the clavicle, for secondary hemorrhage following sloughing in the axilla; Mr. White's case of ligature of the subclavian above the clavicle, for a circumscribed aneurism of the axillary artery following a wound of that vessel; Dr. Buchanan's case of ligature of the right subclavian for secondary hemorrhage from the brachial artery; Dr. Gibson's case of ligature of the subclavian, above the clavicle, for an aneurism in the axilla, from external injury without a wound; Dr. Warren's case of ligature of the subclavian, above the clavicle, for rupture of the axillary artery from violence; Injury of arteries from cannon-shot; Mr. Stanley's case of rupture of the inner and middle coats of the brachial artery from external violence; Sir C. Bell's case of lacerated wound of the axillary artery from machinery; Dr. Post's case of ligature of the subclavian, above the clavicle, for secondary hemorrhage after amputation at the shoulder-joint; M. Haspel's case of ligature of the subclavian, below the clavicle, for a wound of the axillary artery; Question of amputation at the shoulder-joint in such cases; Case of wound of the brachial artery, cured by compression; M. Haspel's case of wound of the brachial artery, and ligature of both ends of that vessel at the seat of injury; Case of rupture of the axillary artery from external violence; formation of a diffused aneurism, followed by amputation at the shoulder-joint; Dr. Mackenzie's case of injury of the axillary artery from a wound with a red-hot poker, and ligature of the subclavian above the clavicle; Remarks on the practice of applying a ligature on the subclavian, above the clavicle, for wounds of the axillary artery; Remarks on the preceding cases; Case of amputation of the arm, followed by secondary hemorrhage, and ligature of the bleeding artery; Occlusion of an arterial branch immediately above or below a ligature placed on the main trunk; Secondary hemorrhage from ulceration of the arteries, in the sloughing state of stumps after amputation; Ligature of the main arterial trunk; Secondary amputation; Treatment of secondary hemorrhage after amputation of the thigh; Treatment of secondary hemorrhage after amputation at the shoulder-joint; Secondary hemorrhage with retraction of the soft parts after amputation, and formation of a conical stump; Opinions of French surgeons on secondary hemorrhage, consecutive to local inflammation, ulceration, or sloughing; Condition of arteries in inflamed parts; Mr. Stanley's case of wound of a branch of the epigastric in the* *operation for femoral hernia: Case of wound of a branch of the external pudic artery, during the operation for castration: Wounds of the arteries of the arm during amputation at the shoulder-joint. Anatomical description of the axillary artery: The operation for applying a ligature on it. Mr. [illegible]'s case of supposed wound of the axillary artery.*

The axillary artery has not fared better in many instances, than the posterior tibial, and peroneal arteries. The same dread of dividing muscular fibres has overcome all other considerations, and instead of placing two ligatures on the part of the vessel actually injured, one above, the other below the wound, the subclavian artery has been tied at a distance from the injury, sometimes below, sometimes above the clavicle, oftentimes to the destruction of the patient, and even when successful, in defiance of the theory on which such proceeding is founded.

Dr. Norris, of Pennsylvania, has collected and published, in the 13th vol. of the *American Journal of the Medical Sciences* for 1845, the results of sixty-nine operations performed on the subclavian artery, either above or below the clavicle. Of the sixty-nine cases, thirty-six recovered, and thirty-three died. This may be considered as one out of two—a result that should cause every surgeon to pause and think again and again before he resorts to an operation, if it can by any possibility be avoided, which may be considered as deadly as it had in thirty-three cases out of sixty-nine. It is [illegible] than an other operation is likely to be less fatal.

Of the sixty-nine cases, seventeen were done in consequence of wounds of the axillary artery, and of these nine recovered, seven died, and one failed to arrest the bleeding, which was only effected by amputating the arm at the shoulder-joint; eight failures against nine recoveries; eight out of seventeen, or in the proportion of thirty-three against thirty-six, the average of the whole sixty-nine being thirty-three against thirty-six.

In the seventeen cases collected by Dr. Norris, the operations were done by Messrs. Chamberlaine, [illegible]. M. [illegible] says that in twelve cases he is acquainted with, three only were successful, but this is certainly more than the average mortality.

The object of these remarks is to show that the operation on the subclavian artery is always a formidable one, and the results do not seem to depend on the soundness or unsoundness of the artery itself; the mortality being equally great in cases of wounded, as of diseased axillary arteries. It may therefore be safely concluded that the danger lies in the operation, and that it should not be performed when another can be substituted for it, unless that other can be shown to be equally dangerous, when the operation becomes a matter of choice, as far as the life of the patient depends. The operation on the axillary artery itself at the part injured, in all cases of wounds, and in all cases of recent circumscribed or diffused aneurismal swellings, the consequence of wounds, is the operation which ought in all cases to supersede it. It is an operation founded on principle, which the other is not, and which I affirm and believe will be found infinitely less deadly.

CASE [illegible].—The first instance on record of the subclavian artery being included in a ligature, is that in which the late Mr. Keate, surgeon-general to the forces, applied it below the clavicle, in the York Hospital, Chelsea, in a case of axillary aneurism formed after a gunshot wound, of some months' standing, which had burst. Mr. Keate, after dividing the pectoral muscle in the course of its fibres, dipped down twice with a needle and thread, and the second time secured the artery. I was present at the operation, and assisted the late Mr. [illegible] in taking care of the man afterwards, who recovered. I was too young to know any thing about the matter, and too much in awe of the surgeon-general to suppose for a moment that any thing he did was wrong. I have however often since thought of the two dips of his needle, and have even ventured to think that the patient was as fortunate in his escape from his doctor as from his disease.

CASE [illegible].—Mr. Chamberlaine, of Jamaica, placed a ligature on the artery below the clavicle, in 1814, on account of an aneurism which had formed in the axilla, in consequence of a wound received from the point of a [illegible], which bled profusely, and healed in three days, leaving a scarcely perceptible cicatrix. The tumour was as large as an orange; the pulsation very strong; the pain from pressure on the nerves very distressing; there was no oedema of the arm; no elevation of the clavicle. The pulsation in the radial artery was not so firm as in that of the other side, and, before the operation, was becoming indistinct. The integuments over and above the tumour were perfectly healthy in appearance. On the 17th of January, eighteen weeks and three days after the accident, a ligature was applied below the clavicle, in the first part of the course of the artery, and the patient recovered.

*Remarks.*—This was the operation of Anel done below the clavicle, and as the aneurism was of eighteen weeks standing, circumscribed, and with little pulsation in the radial artery, the operation was admissible, especially because no aneurismal sac had formed. I am, however, of opinion that if twenty patients were so operated on, and in twenty more the sac were laid open, and the artery secured above and below the wound, that more would escape with life and limb by the latter than by the former operation.

CASE [illegible].—A soldier was wounded on the heights of [illegible] by a musket-ball, which passed through the pectoral muscle in the direction of the axillary artery, and went out behind. I saw him just as he expired from loss of blood, and immediately divided the pectoral muscle to see what injury had been done to the artery. The ball had cut it nearly half across, it could neither contract nor retract, and the man had bled to death. If I had been in time to stop the bleeding, and had tied the subclavian artery, above or below the clavicle, the bleeding would have returned, and the man would have been lost, as the wounds of the integuments could not unite, so as to allow of the formation of a spurious circumscribed swelling. The artery could have been secured at the spot wounded with the greatest ease.

Case 58.—A French soldier at Salamanca received a sabre cut vertically and directly across the pectoral muscle, opening into the axilla, and exposing the vessels and nerves. He was afterwards ridden over and taken prisoner by the heavy German cavalry. The wound was always considered a simple one, and healed without difficulty.

Case 59.—A French soldier, at the battle of Salamanca, received a shot through his chest, and another through the axilla, which bled at the end of several days. I divided the pectoral muscle, and placed two ligatures on the cut artery above the origin of the subscapularis. The hemorrhage was suppressed, but the man died of the injury to the chest.

Case 60.—Delpech, in the case of a soldier who had been wounded in the south of France, in 1814, tied the brachial artery, as dissection afterwards proved, two inches below the subscapular branch, by an incision carried high up into the arm-pit; and according to the opinions of that day in France, he introduced a ligature under the artery an inch higher up, but which he left loose ready to tighten when necessary. On the ninth day afterwards, bleeding took place, and, to his great surprise, he found on trying to tighten the loose ligature that it came through the parts, and had been the cause of ulceration of the artery and of the bleeding. He immediately made an incision two inches and a-half long through the integuments into the wound, in a line between the pectoral and deltoid muscles; having then exposed the pectoralis minor, he divided it near its insertion into the coracoid process of the scapula. The axillary or subclavian artery was then seen, and tied, as it is about to pass between the two roots of the median nerve. This operation was so far successful; matter formed however under the great pectoral muscle and neighbouring parts, and the patient sank on the tenth day under his sufferings.

*Remarks.*—If Delpech had cut through the pectoralis major muscle, he would have left me nothing to suggest, and would have given such free vent to the matter formed under it, and in the axilla, that his patient would, in all probability, have been spared the irritation which caused his death.

Case 61.—M. Galtié, Delpech's assistant in the Hospital St. Eloi, at Montpellier, tied the subclavian artery above the clavicle, in consequence of hemorrhage taking place from the stump after amputation at the shoulder-joint. The patient died on the third day, exhausted. The opening in the artery was between the ligature on the stump and that on the subclavian, and had been occasioned, it was supposed, by hospital gangrene.

*Remarks.* — M. Galtié would have given his patient a better chance for life, if he had divided the pectoral muscle, looked the opening in the artery fairly in the face, placed a ligature above and below the wound, and then cauterised all the parts affected by hospital gangrene with a red-hot iron.

When the British wounded had left Toulouse, I visited Montpelier, and was received by M. Delpech, and the physicians and surgeons of the university, and of the Hospital St. Eloi, with the greatest courtesy. Delpech was then in the habit of cauterising all the cases of hospital gangrene with irons at a white heat, with the greatest success. I mentioned to him that we had gained similar good effects from the potential as he had obtained from the actual cautery, and especially from the use of arsenic, potassa fusa and the mineral acids in all cases of hospital gangrene and sloughing ulcers. Delpech, in his work on Hospital Gangrene, mentions this fact, and although I do not desire to be considered as the proposer of destructive measures for the cure of sloughing ulcers, I may without impropriety, claim to be the proposer or person who first recommended the use of the nitric and muriatic acids in such complaints. They were used liberally and effectively at Brussels and at Antwerp, and are after all, with the red-hot iron the remedies to be principally depended upon in this complaint, pure or diluted as the exigencies of the case may require.

Hospital gangrene often gave rise to hemorrhage, which led in the Peninsula to securing the vessels, sometimes near, sometimes at a distance from the part affected. I have tied the external iliac, the femoral, popliteal, humeral, radial, ulnar, posterior, and anterior tibial arteries, in consequence of their being opened by this disease. Most of these cases were lost, from the extension of the gangrene to the wound made by the operation, until the local destructive measures alluded to were adopted to arrest its progress. The last case on which I operated at Santander, after the battle of Vitoria, succeeded. It was on the anterior tibial artery.

On my way to England I visited Paris. The Baron Larrey received me with open arms, and took me to his hospital at the Invalides. There he heated his irons, and applied them very vigorously to a large ill-conditioned ulcer on the right hip of a French soldier, who could not refrain from a howl that would have done honour to any gentleman whatsoever. The Baron stopped for a moment, looked in the man's face, and said, "Vous êtes de la garde," and then proceeded with his irons. The soldier uttered not another word.

Case 62.—Pierre Cadrieux, aged thirty-two, received a wound, in November, 1811, from the point of a sword, which passed in a direction backwards, downwards, and outwards, from immediately above the clavicle, dividing the outer part of the sterno-cleido-mastoideus muscle, and of the scalenus anticus muscle, and opening into or cutting across, as was presumed, the subclavian artery and vein, as they are becoming axillary or passing over the first rib. The bleeding was terrific, and the man fainted and remained as if dead. A compress was applied, and he was brought to the Hospital of Gros Caillou, and placed under the care of Baron Larrey. The next morning he looked like death, and could hardly speak; the wound, which was somewhat more than half an inch long, did not bleed; a swelling had formed above and below the clavicle, pulsating more strongly above. A peculiar thrilling sound could be felt and heard deeply in the direction of the axillary vein; the arm was cold, insensible, and without pulsation in any of its arteries, not even the axillary. The wound was treated by compress and bandage, the arm with warm camphorated fomentations; the patient being supported by wine and good soup, gradually recovered, and as some excitement followed, the next day he was bled, and cold was applied to the swelling. Under this careful treatment the wound healed on the eighth day, and the patient gained strength and gradually recovered the use of the arm. On the twentieth day, the aneurismal swelling had disappeared, but the thrill remained, with the pulsations of the vein of the neck, which pulsation never became perceptible in the arm. On the fifty-fifth day some slight pulsations could be felt in the arteries of the arm, and the thrill in the vein had diminished. In 1815 the Baron again saw P. Cadrieux, and found to his astonishment that no pulsation could be distinguished in the axillary, radial, or ulnar artery. A change had taken place in the circulation of the limb, which preserved nevertheless, its warmth and sensibility, although the fingers were drawn forcibly into the hand, from the brachial plexus of nerves having been also injured.

CASE 63.—Delpech, in a nearly similar case of wound, in which he believed the common carotid was wounded near its origin, and which was followed by a terrific hemorrhage which almost destroyed the patient, acted in a similar manner, and with the same successful result.

*Remarks.*—These two cases show the propriety of that rule I have endeavoured to establish of letting large arteries alone until they bleed and demand attention. There can be little doubt that if Larrey and Delpech had tried to perform operations on these arteries, they would have lost their patients. It is time enough to put men's lives in jeopardy when the necessity for doing something is manifest. Formidable operations are not to be done on the speculation that they may be required, and this should never be forgotten, for there are several cases on record in which the main trunk of a limb has been supposed to be divided, when, in fact, trifling branches only have been injured.

An artery possesses an elastic and resisting power which enables it to yield in a great degree to an opposing force without being torn, and to suffer a degree of contusion which would lead to sloughing in other parts with little comparative injury.

I published the case of Captain Flack in my work on Gunshot Wounds, page 330, in which several inches of the femoral artery were laid bare by a cannon shot, and were seen for three weeks pulsating in the usual manner, until gradually covered over by granulations. In this case the artery maintained its life and functions unimpaired.

At the battle of Albuhera, Captain Gibbons, of the fusiliers, was wounded by a musket ball, which entered immediately below the clavicle, and passed out behind, so directly in the situation of the axillary artery, that it was supposed it must be injured. Great inflammation followed in the chest, and his life was saved with difficulty. He died of phthisis in 1829; and on examining him particularly, I found that the artery was obliterated at the part where the ball had passed by the side of it. I have seen, however, many instances in which no such event followed. The late General Sir Lowry Cole, was wounded when advancing with the 4th division of infantry to attack the French centre at the battle of Salamanca. The ball passed under the clavicle, injured the first rib close to the artery, and passed out behind, without implicating the artery or giving rise to any inconvenience, further than a diminution of the force and size of the artery at the wrist when compared with the other. At the first siege of Badajos, two officers of the 40th regiment met with injuries nearly similar; and I have seen the subclavian artery as well as the carotid fairly divided; but then death immediately ensued. The fact of arteries yielding a passage to a ball, and recovering themselves and their situation without rupture or sloughing, is well shown in case No. 24, of Turnbull, and is I believe sufficiently established to require no further confirmation.

CASE 64.—L. B., twenty years of age. In Sept., 1811, was wounded by the point of a sword in the right arm, which opened the ulnar artery. The bleeding was arrested by compression, and the wound healed in twenty days. Shortly afterwards a small tumour of an ovoid form appeared under the cicatrix of the wound, which, in the course of a few months, attained the size of a man's first. Larrey tied the brachial artery in the arm above the tumour, and afterwards laid open the aneurismal sac, which was full of layers of fibrous coagula he had some difficulty in detaching; he then sought for the upper and lower ends of the artery, which he thought had been divided and separated by the sword; this had not however happened, but the artery at the wounded part had become dilated, the portion immediately above being funnel-shaped or dilated in that form, the lower end being on the other hand, obliterated; between these two points the interosseous artery entered the sac, and bled so freely as to require a ligature being passed around it underneath the sac. The ligature on the brachial artery came away on the ninth day, that on the interosseous artery on the eleventh, and the patient was cured in six weeks.

*Remarks.*—If the Baron had been contented with his first ligature, his patient would have been well in half the time, and with less than half the suffering. By opening the sac he placed an aneurism of some months' standing in the state of a wounded artery, and had to tie a vessel with a good deal of difficulty, which never should have been exposed.

CASE 65.—Catanoso, of Messina, in September, 1835, was called to a man with a wound in the arm-pit, which oosed blood frequently until the fourteenth day, when an alarming hemorrhage caused him to place a ligature on the artery, below the clavicle, which he found it very difficult to do. The wound did not heal by the first intention, but suppurated, and discharged a quantity of sanious and offensive pus mingled with coagulated blood. It was therefore enlarged to give free vent to the discharge. On the nineteenth day after the operation, arterial hemorrhage took place. The clots being removed, the hollow whence the blood proceeded was filled with resin, charcoal, and gum arabic, retained by compresses and a tight bandage. The hemorrhage did not return, but the cure took some months to complete.

*Remarks.*—If the operator had divided the anterior fold of the arm-pit by a vertical incision, and placed one ligature above and another below the wound in the artery, his patient would not have had in all probability secondary hemorrhage, and would have been cured in half the time, and with much less risk.

CASE 66.—Montanini, of Naples, tied the axillary artery below the clavicle, sixteen days after the accident, in a case of wound which healed early, and allowed an aneurismal tumour to form, the size of the fist. Six days afterwards the tumour burst, and about five ounces of coagula were discharged. The sac suppurated, but no bleeding took place. An abscess formed under the pectoral muscle, requiring to be opened. The patient was cured in thirty-six days.

*Remarks.*—The inflammation of the sac which led to its rupture on the sixth day, closed the axillary artery below in all probability, or the patient would have bled to death, unless another operation had been performed to tie it also.

CASE 67.—C. Chevalier, aged thirty-seven, was wounded, in 1811, in Spain, by a thrust with a sword on the back of the shoulder, which caused him to faint after a great loss of blood. The wound healed in three weeks. Two months afterwards he perceived a small tumour in the axilla, about the size of a nut, and pulsating. Two years afterwards it was as large as a hen's egg, and after some laborious exertions it rapidly attained the size of a child's head. M. Dupuytren tied the artery above the clavicle, between the two scaleni muscles, the anterior of which was divided; the man escaped, and at the end of several months resumed his occupation of a joiner, and enjoyed good health for three years. The tumour did not entirely disappear, for after a great exertion, inflammation and pain came on in the axilla, and he applied at the Hotel Dieu again in 1822. At the end of a fortnight it suppurated, burst, and discharged a large quantity of matter, having the colour and consistence of pounded raisins. The opening was enlarged, the sac injected, and he left the hospital, cured, in three months.

*Remarks.*—This was an aneurism formed after the manner supposed in cases 55 and 56. Being of long standing, the ligature of the subclavian above the clavicle was admissible, but there can be no doubt that this man would have run less risk, if the sac had been laid open when of the size of a hen's egg.

CASE 68.—Lallemand of Montpellier (*Archives Générales de Medecine*, vol. vii.) was called to a young man who was wounded by the point of a sword through the middle of the anterior fold of the arm-pit, and lost a good deal of blood at the time; but as the small wound became obstructed, the blood only oozed out; a large effusion, however, took place into the arm-pit, and into the cellular membrane of the chest, arm, and neck. M. Lallemand with great difficulty tied the subclavian artery above the clavicle. On the twelfth day the ligature separated, but the diffused aneurismal tumour became larger and more painful; fluctuation being manifest, a puncture was made into it, and an enormous quantity of chocolate coloured matter was evacuated, together with many large black lumps of coagulated blood. The day after another swelling required another puncture, for the evacuation of a further quantity of fetid pus, with sloughing cellular membrane, &c. A third abscess formed, and required another puncture, followed by similar results. A month after the operation the pulse returned in the radial artery, eight days after in the ulnar, and the patient ultimately recovered.

*Remarks.*—If an incision had been made at first, through the anterior fold of the arm-pit, the coagulated blood would have been readily evacuated, the wounded artery would have been tied, and the patient cured without difficulty. If the collateral circulation had been early established, this operation would have been necessary to stop the bleeding which would have taken place. This man had a lucky escape from his accident and his operation.

CASE 69.—It is stated in vol. xxx of the *Med. Chir. Review* that a young man was brought to Professor Blasius, of Hallé, with a wound through the posterior fold of the arm-pit from a sword; he bled profusely and on several occasions. On the twentieth day after the accident, Professor Blasius tied the subclavian below the clavicle, and the patient died from exhaustion two days after. On dissection the axillary artery and vein were found uninjured; the bleeding had taken place from the circumflexa humeri posterior and circumflexa scapulæ arteries. Dr. Blasius condemned in severe terms the negligence of not laying bare the artery or arteries wounded, and applying a ligature to them, instead of upon the main trunk, which was unhurt.

*Remarks.*—It is plain that if these arteries are of any use in the collateral circulation, bleeding must be renewed by them, after the subclavian has been tied above their origin, unless they should be accidentally closed in the interval. I need not add to the forcible criticism of Blasius, which is unanswerable. In this, as well as in Case 67, the posterior fold of the arm-pit might have required to be divided instead of the anterior.

Case 70.—Dr. Monteath, of Glasgow, was called to a gentleman on the 20th of September, 1813, whose right arm had been run over by a heavy coach, about its middle, and bruised from the shoulder to the wrist without lacerating the skin. Great inflammation ensued, followed by suppuration, the matter being evacuated by an incision over the biceps muscle, twelve days after the accident. This was followed by great sloughing of the integuments, and on the twentieth day by hemorrhage inducing syncope. Hemorrhage again took place, and some operation to arrest it was necessary. The gangrene had extended close to the boundaries of the axilla, and the axillary artery was, therefore, secured by ligature as high up as it could be got at by an incision at the arm-pit, under the anterior fold made by the pectoral muscle, and, as Dr. Monteath believes, above the origin of the subscapularis and circumflex arteries. The patient recovered with an arm, after a time, "in all respects perfect."

The Messrs. Maunoir of Geneva, performed nearly a similar operation, after a sword-wound, with success. Desault, Langenbeck, and Roux, have each recommended the division of the pectoral muscle for this purpose, and if Desault had been better acquainted with the management of the ligature, success would have attended his efforts, and he would have left me nothing to propose, but to follow the example he set in 1795, in the following case.

Case 71.—The point of a sword passed through the pectoral muscle, an inch above its lower edge; a great quantity of blood was lost, and a large swelling formed in the axilla, between the folds of the arm-pit. Seven days afterwards the man was admitted into the Hotel Dieu. An incision was made in the course of the axillary artery, commencing below the clavicle. The two lower thirds of the pectoral muscle were divided, and the coagulated blood removed from the axilla, so as to expose the artery, veins, and nerves. So far the proceeding of Desault was to be applauded. He then included all the vessels and nerves in one mass by a temporary ligature. The artery was then separated, and tied separately immediately above the origin of the circumflex and subscapular arteries. The temporary ligature was then loosened, but was not removed. No more ligatures were then applied below the wound in the artery. The man died six days afterwards of mortification.

*Remarks.*—If in this case Desault had placed two ligatures on the artery, one above and the other below the wound in it, instead of four, without fear of being unable to command the bleeding, his patient would, in all probability, have recovered.

Case 72.—Dr. Segond, in French Guiana, in April, 1834, was called to a wound of the axillary artery in a negress, which took place by a fall in February. The fourth or fifth day after the accident she lost a great quantity of blood; at the end of a month she seemed nearly well, with the exception of a small abscess, from which a little bloody discharge took place, and in which an aneurismal tumour had formed. The subclavian above the clavicle was tied, and the patient recovered very fortunately.

Case 73.—Dr. Nott, of Alabama, U. S., was sent for to C. Clausel, aged thirty, shot through the wrist and axilla by small shot on the 27th of August. The wrist was amputated. A slough formed in the axilla. On the twelfth day hemorrhage took place to the extent of two pints, returned on the thirteenth, and again on the sixteenth; it was arrested by compression. On the eighteenth day the slough separated, leaving a large cavity in which the artery could not be felt. By the middle of October the cavity had filled up, and the ulcer had nearly healed, when an aneurismal tumour began to form and gradually extended up to the clavicle. On the 29th of November a ligature was placed on the artery above the clavicle. On the thirty-first day this came away, having been so tightly tied that an ordinary sized pea could hardly be passed through the noose after it came away. On the fortieth the wound had healed, but the pulsation which had returned on the second day after the operation was still strong and the *purr* distinct. These had a little diminished in five months, and the patient was found to be cured two years afterwards.

Case 74.—Mr. White, of the U. S., tied the subclavian above the clavicle, in September, 1838, for a wound of the axillary artery, which had formed a circumscribed aneurism likely to burst. The operation succeeded.

Case 75.—Dr. Buchanan relates a case in the third volume of the *Glasgow Medical Journal*, in 1830, page 233, in which he tied the subclavian artery of the right side in consequence of hemorrhage from the brachial artery, the result of the separation of mortified parts after a severe injury. The man died five days after the operation. The post-mortem report says, after the parts had been dissected, and the scalenus anticus muscle had been cut and turned aside, "the subclavian artery was well seen with the ligature firmly tied round it, and a hard clot of blood perceptible on its cardiac side. The clavicle was then removed, and the axillary artery traced under the pectoralis, onwards to its termination in the stump, during which transit it seemed quite healthy, till about an inch below the axilla, when it assumed a soft, greenish appearance, and no clot could be discovered on the distal side of the ligature. The muscles surrounding the shoulder joint were soft, green, and matted together, and a large collection of fetid pus extended from the slough below the axilla, to the under surface of the pectoralis major and minor, the whole substance of which last was in the same gangrenous state as the muscles of the shoulder-joint."

*Remarks.*—Dr. Buchanan justly attributes the immediate cause of death to mortification of the extremity, but he does not seem to consider that its continuance and extension were at least maintained and encouraged, if not rendered inevitably destructive, by his having cut off the supply of blood around the shoulder, by tying the subclavian artery above the clavicle. This he did, because he supposed the operation of tying the artery under the pectoralis major and minor to be an operation which had never been done, and says, "Further, I am of opinion it never ought to be had recourse to." This was Dr. Buchanan's error. The very simple operation of dividing the integuments and pectoralis major muscle from a little below the clavicle into the axilla would have exposed the artery, which it will be seen from the dissection report was quite healthy, even for an inch below the axilla. This incision was also necessary, if for the purpose only of giving a free vent to the matter collected under the pectorales major and minor, and around the shoulder-joint. It would have tended to arrest the sloughing process, and the arm, having the advantage of the collateral branches which were cut off by tying the subclavian, might not have been lost. It is possible the man might not have died.

I have stated that the principal trunk of an artery may be injured by internal and by external violence without any wound of the integuments, of which the following cases are examples :—

Case 76.—Dr. Gibson, of Pennsylvania, after reducing an old dislocation of the head of the humerus of ten weeks' standing, on 15th of March, 1828, which occupied one hour and a half, discovered the next day that an aneurismal tumour had formed in the axilla; and on the 17th he tied the subclavian artery above the clavicle; mortification of the hand and arm followed, and the man died on the 23rd. On dissection it was found that a small aneurismal sac had been ruptured, and which it was supposed might have existed from the period of the accident.

Case 77.—James A., aged about thirty, on the evening of December 23rd, 1843, while in a state of intoxication, slipped on ice, fell, and struck his left shoulder against the kerb-stone of the side walk. Violent efforts were made to reduce the dislocation, but in what manner the patient could not tell, excepting that he thought one person placed his foot with a boot on, in the axilla. He was sent to the hospital, and on the next day was seen by Dr. Warren, who found the left arm and shoulder much swollen. Leeches and cold applications were employed, and on the following day the swelling was so much reduced as to enable him to decide that no dislocation existed. During the night of the third day following (December 28th), the patient was seized with a violent fit of coughing, during which he felt something give way in his shoulder. The next morning the shoulder and arm were very much discoloured and enlarged; the arm was painful, and the patient much prostrated. On the 30th it was discovered that the man had no pulse in his left wrist, or in any part of the arm, and he had also lost both feeling and motion in the extremity. The swelling increased until it became enormous, the arm turning black in the axilla. A vesication was noticed on the back of the forearm. January 27th, 1844, an abscess was found to be forming in the axilla. In seven days it pointed, but did not open till February 4th, when it discharged a coagulum, and about a pint of fluid dark-coloured blood. Three days subsequently, at six o'clock in the morning, a sudden gush took place from the wound, by which the bed was inundated, the mattresses soaked, and the blood poured upon the floor. Exhausted and almost lifeless, he sunk into a state of syncope, and the hemorrhage ceased. As he was too low to undergo any operation, it was agreed that if he lived till the next day, the subclavian should, if possible, be tied. By the next morning, he had much revived. At ten o'clock he took eighty drops of the tincture of opium, and at eleven was carried into the operating theatre.

A great difficulty presented itself in the outset of the operation, the swelling of the shoulder, the tumour in the axilla, and the natural shortness of the neck almost obliterating the space between the shoulder and lower jaw. Dr. Warren, after minutely detailing the steps of the operation, states that the aneurism-needle was passed under the first dorsal nerve, which was mistaken for the artery. The wound was too deep, too narrow, and consequently too dark, to permit the artery to be visible. The anterior scalenus was partially visible, and, passing the forefinger of the hand to the edge of this, a good portion of the muscle was divided by the probe-pointed bistoury, introduced upon the finger. The subclavian artery then became quite sensible to the touch, and slightly distinguishable by the eye. A long aneurism-needle was passed under the artery, and at this moment a slight whistling was heard, and the author was satisfied that some air had entered the thorax. The ligature was tied, and the wound closed.

The patient improved after the operation. On February 22nd, the thirteenth day, the ligature was removed. On the 29th, a stream of blood was seen to issue from the unclosed part of the wound; the blood lost amounted to about a pint, did not issue per saltum, and was of a venous colour. The hemorrhage was arrested by pressure. At the commencement of March, he had an attack of pneumonia, confined to the lower lobe of the left lung, and also a second attack about the 1st of May. By the 1st of October, the swelling had disappeared from the arm, and motion had returned in the shoulder-joint. The large excavation in the axilla was reduced to a fistulous tube. On February 4th, three hundred and sixty-one days after the operation, Dr. Warren was able, for the first time, to detect a distinct pulsation in the radial artery, and subsequently one of an indistinct character in the ulnar and brachial. The patient, June 15th, had nearly recovered. There were still fistulous openings in the neck and axilla. Sensation and motion were slowly improving.

Dr. Warren remarks, that the cause of the rupture of the subclavian artery in this case is involved in some obscurity. The probability seems to be, that great violence was employed in the attempt to reduce the bone, and that the arteries and nerves were contused by strong pressure of the operator's boot, combined with the forcible extension of the arm. The vessel did not rupture immediately, because its coats were contused, and not torn asunder, but a separation of the contused parts took place, in consequence of the violent efforts of coughing, on the fifth day after the accident.

*Remarks.*—I have had the pleasure of making the acquaintance of Drs. Gibson and Warren, of whose private character and professional attainments it is impossible for me to think too highly. They are universally acknowledged. I am therefore the more willing to express my dissent from the principle on which they acted in these instances. In Dr. Gibson's case the mortification which ensued after the operation might not have occurred if the aneurismal tumour had been opened, and the artery had been secured above and below the part injured; for I consider the mischief to have arisen from an injury, and not from disease of the artery. If Dr. Warren had cut across the integuments and the pectoral muscle in his case, and laid open the tumour in the whole of its extent, he would have been able to see the torn or even ulcerated part of the artery whence the bleeding came; for as the vessel was injured by the heel of the boot of the person who reduced the dislocation, provided there had been one, the artery must have been injured in the third or last part of its course before it becomes humeral, and the patient would in all probability have been perfectly well in two months, even if it should have been subsequently necessary to have placed a ligature on the lower end of the divided vessel, that is, the upper end of the humeral artery. The man nearly lost his life on the 29th of February from hemorrhage of a venous character, caused by the operation on the subclavian artery, which danger need not have been incurred, and he ran the risk the whole time of an arterial bleeding being renewed from the cavity in the axilla. When it shall be shown that the operation of dividing the pectoral muscle, and of tying the axillary artery at, under, or above the pectoralis minor muscle is more dangerous than tying the subclavian artery above the clavicle, I will yield my opinion that the subclavian artery should not be tied above the clavicle; but in the meantime, I may be permitted, without any great presumption, to say that this operation will be found to be at least three times more deadly in its average result than the other.

When a cannon shot strikes a limb, and bruises it most severely, without carrying away any part, constituting a sort of injury which I have explained, page 128 of my work on Gunshot Wounds, the great artery or arteries may be ruptured, not only in one spot, but the internal coat may be injured in several. I have given an account of one particular case, in which on dissection it was found that the posterior tibial and fibular arteries were torn across, and the popliteal artery, two inches higher up was closed by coagulable lymph thrown out from a rupture of the internal coat of the artery at this part. The limb mortified. These cases are supposed erroneously to have occurred from the wind of a cannon ball.

Case 78.—A boy, twelve years of age, had a waggon wheel pass over his arm and thigh. In the thigh there was a compound fracture. In the arm there were no other outward marks of injury than two or three small wounds, penetrating only the skin; but the arm throughout was cold and pulseless. In the axilla the pulsations of the artery could be felt, but nowhere below it. On the morning after the occurrence of the injury, the boy became delirious, and in the evening of this day he died.

Mr. Stanley on examining the arm found the biceps torn across its middle, and in the same situation the trunks of the vessels and nerves were all separated from each other by the laceration of their connecting cellular tissue. The brachial artery, for about two inches of its extent, appeared to be remarkably small, and on slitting it open, its inner and middle coats in the middle of the arm were found to be completely divided, the outer coat being entire. For nearly two inches above the laceration of the inner and middle coats, the canal of the artery was extremely contracted, and filled by a slender solid coagulum.

Mr. Arnott has noticed a nearly similar degree of mischief as occurring after the passage of a wheel over the limb, and this accident has been observed by others, and particularly by Mr. Turner, in the Transactions of the Medico-Chirurgical Society of Edinburgh.

Wounds of the axillary artery have been treated not only by ligature of the subclavian artery, but also by amputation of the extremity at the shoulder-joint—a mode of proceeding the expediency of which deserves consideration.

Case 79.—Sir C. Bell says in his Commentary on John Bell's Surgery, vol. i, p. 369, "a girl had her arm torn off near the shoulder by machinery. There was no bleeding, nor could the trunk of the artery be seen. As the arm had been almost fairly amputated by the machine, it was unnecessary to do more than make the edges of the wound even, and bring them together. As the axillary artery had not been tied, the patient was carefully watched. In the course of a few days hemorrhage did come on, and the surgeon very properly tied the artery below the clavicle. The bleeding from the stump immediately stopped, and everything went on well for several days; the stump became clean, and was granulating, when a second violent hemorrhage took place from it. The surgeon did not reach the hospital until the patient had lost a considerable quantity of blood. He immediately tore open the stump, which was already partly united, and then he saw the blood issuing from the main artery. He secured it; but the patient sunk next day. On dissection, and by injecting the vessels, it was shown that the artery, where it had been tied below the clavicle, was obliterated, and that the blood had passed round by the supra-scapular branch of the inferior thyroid, from the portion of the subclavian artery above the ligature into the part below."

*Remarks.*—The surgeon in this case performed a very dangerous operation in a very admirable manner, and according to the principles he had been taught. Nevertheless, it was done contrary to every principle of good surgery, and, as far as I can see, for no other reason than for the purpose of avoiding a few fibres of the pectoral muscle.

In the first place, an operation, confessedly a very dangerous one, was done when it was in no way necessary, and which proved perfectly useless, a second requiring to be performed afterwards, of a very simple kind, and which was the one which ought to have been done at first, namely, searching for the bleeding end of the artery, and tying it. A life was here lost for want of a knowledge of principles. The operation failed, not for want of anatomical knowledge or dexterity, but from misapplication.

Case 80.—Dr. Post, of New York, was called to a ropemaker, who had divided the axillary artery becoming brachial, together with the veins and nerves, by a scythe. The ligature of the artery and the division of the vessels and nerves was followed by mortification of the arm, requiring the operation of amputation, which was performed two inches below the shoulder-joint. The artery which was found in a denuded state, being secured by a second ligature, placed three quarters of an inch above the one applied on the extremity of the artery in the stump. On the 30th of November, fourteen days after the operation, the patient was awakened by bleeding from the wound; the ligature having come away a day or two before, this was arrested, and there was no return of the bleeding until the 6th of December, when a profuse arterial hemorrhage took place, and the subclavian artery was tied above the clavicle. On the 9th of April he left the hospital, the wound over the clavicle, and the stump, the bone of which had exfoliated, being nearly healed.

*Remarks.*—This patient recovered, whilst No. 76 died of mortification and No. 79 of hemorrhage. The artery, in my opinion, ought to have been secured by an incision through the parts intervening above the vessel, and the ligature placed upon it below the edge of the pectoralis minor, where the artery would, in all probability, have been sound. It would then have been seen whether or not the subscapularis and circumflex arteries brought blood into the main trunk below this ligature, from their collateral connections, and required to be secured. If this operation, a very simple one in such a case, had failed, the greater one on the subclavian would have been a resource, and if that had not succeeded, the innominata need not have been spared, when the theory would have been carried out on the most *ultrà* principles to that consummation which may be expected from it.

Case 81.—Bigneux, of the 1st battalion of artificers, was wounded in the arm-pit in a duel, on the 4th February, 1835, at Metz, and suffered a considerable loss of blood. The anterior fold of the arm-pit was divided, and on examining the wound, a jet of blood, as large as the finger, darted from it. M. Haspel laid bare the subclavian artery by a separate operation below the clavicle, and secured it by ligature. The hand and forearm mortified; the limb was amputated; in a few days the man died. On dissection, a considerable effusion of blood which had formed into large clots was found in the cellular membrane at the back of the shoulder, and which M. Haspel supposes would have led to such irritation and suppuration, as might have placed the patient in great danger if he had survived. The ligature was found on the artery an inch and a half above the part where it was divided.

*Remarks.*—M. Haspel offers for the consideration of surgeons the question, whether it would not have been better to have amputated the arm at the shoulder in the first instance? I am of opinion that if he had enlarged the wound upwards, placed a ligature on the artery, immediately above where it was divided, and another in a similar manner on the lower end of it, this patient would have preserved his arm and his life. The clots of blood would have been discharged through the enlarged and dependant wound he had made, the patient being able in such cases to maintain an inclined if not an erect position for the greater part of each twenty-four hours.

Case 82.—M. Renneville, captain of cuirassiers, was wounded in a duel by a sword, which cut through the inside of the upper part of the arm, and gave rise to considerable hemorrhage, which was stopped by compression. The radial artery ceased to pulsate until the third day; the compression being continued in the course of the upper part of the artery, the wound healed, and the patient recovered, the brachial artery being obliterated for the space of about two inches. This case is a counterpart to No. 2.

Case 83.—Delahaie, sergeant 33rd infantry, was wounded by a sword, which divided the brachial artery at the upper part of the arm, close to the armpit. The artery was divided in the wound, together with the median nerve, and the lower end of the vessel was readily tied; the upper end had retracted, and could only be found after enlarging the upper part of the wound, when a ligature was applied, which came away on the twelfth day. The patient recovered.

*Remarks.*—M. Haspel, it would appear, had taken warning by what had happened in 1835, to Bigneux, and adopted a different course in 1839, a proceeding worthy of imitation, and highly to his honour.

Case 84.—On the 23rd of September Mr. A., twenty-three years of age, was thrown out of a gig upon the road with great violence, and lighted on his left shoulder. It was at first thought that the humerus had been dislocated downwards; on more careful examination, it appeared that the bone was in its proper place, and that the hard tumour in the axilla depended on effusion of blood. The patient was kept quiet in bed, with cooling lotions applied to the injured part. For a day or two the swelling increased, extending down the arm, and the side of the body, and attended with discoloration of the skin. On the tenth day after the accident, a sensation of gushing was felt in the armpit, and the pain and tension suddenly became as great as ever. Leeches were applied, and the case again proceeded favourably for eight days, when another gush took place. Attacks of this kind then became more frequent, and at length occurred almost daily. They were always relieved by leeches, of which about three hundred had been applied. The arm was now enormously swelled by œdematous effusion, which extended to the points of the finger. A large fluctuating tumour occupied the axilla, and distended the pectoral muscle. There was no pulse at the wrist, and not the slightest movement or sound could be perceived in the swelling. The patient, worn out by pain, loss of blood, want of sleep, low diet, and apprehension, was reduced to a state of extreme weakness. In these circumstances it seemed difficult to determine whether there was an axillary aneurism or merely a bloody effusion. The gushing sensation, and absence of pulse at the wrist were in favour of the former view, while the complete absence of pulsation and aneurismal bruit in the tumour, from its commencement and during the whole period of its existence, could hardly be accounted for, except by the latter explanation. The case being thus doubtful, and as pressure had not been tried, it did not appear prudent to resort to any operation, until the effect of careful bandaging had been ascertained. A flannel roller was accordingly applied from the fingers to the shoulder and round the chest. He derived great comfort from the bandage: the swelling of the arm was considerably reduced, and there had been no return of the gushing sensation. He continued in this satisfactory state for three days, but on the morning of the 24th, severe pain was felt in the most prominent part of the swelling. This corresponded with the hollow of the axilla, and formed a round prominent tumour, of a dark-red colour, apparently about to break. An opening was made to the extent of half an inch, when a small clot of blood only was squeezed out, and a piece of lint was laid loosely upon the wound. Four hours afterwards the piece of lint was observed to be wet with arterial blood, a jet of which immediately followed. By means of a pin thrust through the lips of the wound, and a ligature tied round it, further hemorrhage was prevented for the time. The subclavian artery was now tied with a single silk ligature. The patient passed the remainder of the day tranquilly, and in the forenoon of the next seemed to be going on well. But at two o'clock, p. m., two or three ounces of blood escaped from the wound in the axilla, and a compress of lint was then secured over it by means of a spica bandage. At seven next morning, as the bleeding returned to somewhat larger extent, the surgeon stuffed the orifice with lint. At eleven, a. m., it was thought right to lay open the cavity, turn out all the clots that could be reached, and apply graduated compresses. When the artery was thus exposed it bled freely, but not with such force as to resist the pressure of the lint. In half an hour afterwards, however, the hemorrhage recurred, and as the temperature of the arm was then distinctly lower than natural, the only remaining resource seemed to be amputation at the shoulder-joint, which was done. The patient, for several hours after the operation, threatened to sink under this final act of his trials. He complained of nausea, and was deadly pale; his face was covered with cold perspiration; and his pulse could hardly be felt. Small quantities of wine were given to him frequently, and in the evening he revived, feeling warm and comparatively comfortable; the pulse became firm and could be counted—160. Next day it was 140; the day following, 120; and so on until it fell to the natural state. In other respects the improvement was equally progressive, and before the end of a week there was no room for anxiety, except on account of the ligature above the clavicle. It was longer in separating than usual, but probably lay loose for some time before it came away, owing to the patient's extreme aversion to let it be touched. His recovery was complete both in regard to the wound and the general health. The points in this case most deserving of attention are:—1. The way in which the artery was ruptured; 2. The absence of pulsation and aneurismal bruit in the tumour; 3. The inefficacy of tying the arterial trunk at a distance from the rupture, and with the intervention of branches; 4. The success of amputation in very desperate circumstances. Whether pulsation was prevented by the artery being torn entirely across, and whether ligature of the subclavian would have proved effectual if not preceded by puncture of the tumour, are questions which the writer of the case leaves to the consideration of the reader.

*Remarks.*—This case gives support to the fact I believe to be sufficiently established, that the bruit, hiss, or aneurismal sound which may be heard by applying the ear to the part when an artery of size is wounded, is not always distinguishable through a quantity of blood which has been suddenly effused and has coagulated, whether from a wounded artery or from the rupture of an aneurismal sac, although it is distinct as long as the blood remains fluid. Pulsation is equally indistinct when the blood effused is coagulated, although the swelling may be elevated like any other tumour by the proximity of the artery, particularly if the main trunk is uninjured, and the blood has been poured out by a branch. The swelling was opened simply to prevent its bursting disadvantageously, and if the operator, on finding that arterial blood flowed in such quantity as to render further proceedings necessary, had laid open the tumour in all its extent, as he was obliged to do two days afterwards, and had secured the artery above and below the wound in it, the patient would not have lost his arm, nor have run so much risk of his life, as the operation on the left subclavian artery always occasions.

Case 85.—Dr. Mackenzie was called, on the 5th of November, 1845, to a man who had fallen, with the whole of his weight, on a red-hot poker, the point of which entered the right axilla, immediately below the tendon of the pectoralis major, and seriously burned all the parts it touched. Eight days afterwards, a large eschar separated, followed by a copious flow of blood, which was arrested by pressure. The continuance of this by means of a graduated compress and bandage, evidently did mischief to the surrounding parts, and as the bleeding recurred, from time to time in spite of it, something more was clearly necessary. Three courses were, it was thought, open to the surgeon: one to cut through the pectoral muscle, and to place a ligature on the artery, above and below the part injured; the second to tie the subclavian artery above the clavicle, and if this should not succeed, in consequence of the collateral circulation re-establishing the hemorrhage, the arm was to be amputated at the shoulder-joint, under the advice of Mr. Syme as the third and last resource; because as Dr. Mackenzie says, "the vessel would probably have been divided in the incisions, above the injured point;" and the patient was in a state by no means unfavorable for the performance of such an operation. Again, the anastomosis existing between the branches of the axillary and subclavian arteries, rendered the propriety of trusting to a ligature of the latter vessel, as a means of arresting the hemorrhage, questionable. The subclavian was tied above the clavicle, the bleeding did not recur, and the patient recovered.

*Remarks.*—The four cases, Nos. 79, 81, 84, and 85, may be properly considered together. Four men of the greatest ability and eminence in their profession, tied the subclavian artery on account of a wound of the axillary artery; it is admitted that in all four cases the wound was below the origin of the subscapular if not of the circumflex branch. These vessels are acknowledged to be essentially necessary for the preservation of the life of the limb, the blood being brought round from the neck and shoulder by their means into the principal trunk, the canal of which was obstructed above by the ligature placed upon it. When blood had been so brought round into the main trunk above the hole in it, it is fair to inquire what was to prevent its flowing through it, and renewing the bleeding? The answer must be, nothing, unless a coagulum had accidentally formed to stop up the hole, which a very slight impulse or motion of the patient might remove, as it has been shown has taken place in many cases that have been related; or that healthy inflammation had taken place in the artery, and had clogged its canal by the usual processes of effusion, and consequent obliteration, both being matters of mere chance. In Sir C. Bell's case, No. 79, the blood did so come round the shoulder, did renew the bleeding, and thus destroyed the patient. In Mr. Stanley's case, No. 49, one inch and a-half, at most, of distance between two ligatures on the posterior tibial artery did the same thing; no reliance can, therefore, be placed on any presumption or idea that the collateral circulation will not always do so, and that the patient will not always be destroyed in a similar manner. In case No. 81, that of M. Haspel, the subclavian artery was tied for a wound of the axillary artery through the anterior fold of the arm-pit; the arm mortified, the limb was amputated, and the man died. The collateral branches failed to restore the circulation, and the bleeding was not therefore renewed; its failure caused the limb to mortify, and the man suffered an unnecessary painful operation and died. Death in either way. In case No 84 the subclavian artery was tied for a diffused but bleeding aneurismal swelling in the axilla after a wound. The collateral branches restored the circulation, and the bleeding was renewed. The wound was then laid open, the surgeon saw the artery bleeding freely, and concluded his operation by amputating the arm at the shoulder-joint, instead of placing two ligatures on the bleeding vessel, which might have saved the arm. The patient slowly recovered.

In this case, the operation on the subclavian artery was thoroughly useless; its utter insufficiency is honestly admitted by the operator, and the case should be borne prominently in the recollection of every surgeon. In case No. 85, the ligature on the subclavian artery above the clavicle succeeded in arresting the bleeding from the axillary artery, although the surgeon distinctly states that the opening in this vessel was below the origin of the three great communicating branches with the arteries above, and why the bleeding was not renewed by their bringing blood into the main trunk above the hole in it, no one can tell. It was on a matter of chance that this man's life depended; the surgeon hazarded the risk, and won. Of the four sufferers, the practice pursued failed in three cases; two died, one lost his arm at the shoulder-joint, and one only recovered, and this in the hands of four as able surgeons as any in Europe. If the question were asked, "Is the injury that befel these men in itself so deadly?" my reply would certainly be, "No, the mischief was not so much in the nature of the accident as in the defective nature of the means employed to remedy it. It is the surgical operation which is deadly, and not the injury."

Case 86.—Corporal Wm. Robinson, 48th Reg., was wounded at the battle of Toulouse by a shell, which rendered the amputation of his right leg necessary, and fractured the humerus of the same side, opening also extensively into the elbow joint. I amputated the arm close to the shoulder joint, on the 1st of May, eighteen days after the injury. At the end of the month there was only a line of incision, the lower part of the wound not being quite cicatrised. The ligatures had all come away regularly. At this part a small abscess formed, and discharged itself in the beginning of June, arising, doubtlessly, from a portion of the tendon of the pectoralis major having sloughed after its separation from the bone by the operation. On his arrival at Plymouth, the little abscess formed again, and was opened on the 2nd of August, 1814, three months after the amputation; and the next day blood flowed so impetuously from this part as to induce the surgeons in charge to open the face of the stump, and to seek for the bleeding vessel, which they could not find, owing to the diseased state of the parts surrounding it. They therefore decided upon placing a ligature on the artery higher up and below the clavicle. The man had been brought from Bordeaux by the late staff-surgeon Dease, who had served with me on different occasions, and especially at Toulouse; and the operation was done by Mr. Downing, the deputy inspector of hospitals, and in the manner I had pointed out in the lectures on these operations I had delivered in one of the principal hospitals at Toulouse, after the failure of Case No. 9. An incision, commencing at the centre of the clavicle, was carried down to the inferior part of the axilla, directly through the integuments and the pectoral muscle; the pectoralis minor was then divided, and the artery exposed; two small arteries were tied which had been divided. Great difficulty was then experienced, and much time was lost from the want of an aneurismal needle sufficiently firm to keep its curve, which the silver-eyed probe they had would not do. The ligature was however at last placed on the artery, and came away in a reasonable time. Corporal Robinson was forwarded to me afterwards at the York Hospital, Chelsea, and again became the subject of a clinical lecture, given in proof of the advantages to be derived from this mode of operating. The only error committed was in searching for the artery so long in diseased parts on the face of the stump, instead of at once cutting down upon it an inch or more above its extremity, but below the pectoralis minor muscle, which might afterwards have been divided, and the wound enlarged upwards, if it were found necessary. If this operation had not succeeded, the ligature of the subclavian above the clavicle was a further resource, but as the artery was sound, with the exception of the end engaged in the face of the stump, there was no reason why a doubt should be entertained of the success of an operation, which was, in fact, attended with comparatively little risk to the patient.

It is immaterial how many incisions are made in the folds of the arm-pit or around the breast and shoulder, as long as the arm will hang on alive it is to be preserved. Those poor fellows who have survived the most desperate injuries of the kind know well the value of the under use of the arm, although the shoulder should be stiff. Amputation is moreover an opprobrium to surgery, which cannot be admitted but as a last resource—as the only means left untried of saving life.

I cannot, then, recede from the opinions formed on these points from the practice of the Peninsular war, and although I regret being obliged to differ from so many highly accomplished and able surgeons, I am obliged to declare that in no case in my opinion is amputation at the shoulder-joint admissible on account of a wound of the axillary artery, unless mortification of the extremity has taken place.

There is a very important point growing out from several of these cases, which must not be overlooked. It is admitted by the facts stated in many of them that the axillary artery was injured below the giving off of the subscapular and circumflex branches to the shoulder and parts around it. If a ligature had been applied on the main artery in cases No. 79, 81, 84, 85, at the part injured in the first instance, it would have been placed either above or below the circumflex arteries. If above them, it would or ought to have permitted the renewal of the bleeding through their collateral connections, and the operation would have been useless. If below them it would have been at the part injured, and a ligature above would have been unnecessary. Whether applied immediately above or below, it is said it would have prevented the consolidation of the artery by its proximity. This is a supposed fact I not only doubt, but entirely disbelieve on the ground of experience, founded on observation. It is a point on which I have ventured for many years to call in question the accuracy of most of my predecessors and contemporaries, and of the unsoundness of which I have given proof. It is my belief that if a ligature were placed on the axillary artery immediately below the origin of the posterior circumflex artery, that the orifice of this vessel would become obstructed in consequence of the extension of inflammation to it at the same time as to the canal of the main trunk. If this small artery were given off half an inch above the ligature, it would in all probability remain pervious, and in an healthy artery (although not in a diseased one), I do not think this degree of proximity would be of the least consequence in preventing the permanent obliteration of the extremity of the canal below it. The point on which a distinct answer must be given is, whether it is safer to apply a ligature immediately below or above the origin of the posterior circumflex artery, having the power of selecting either place? The answer is, it is safer to do so below, for the orifice of the artery will not interfere, it may be expected, with the consolidation of the main trunk under and above the ligature; while if tied above, the same orifice would open into an exposed and suppurating wound, in which the processes necessary for its closure might not take place. It might then bleed some days after the operation, and render the application of another ligature on the part injured necessary.

In my work on Gunshot Wounds and on the Operations of Amputation I have said, page 302, 3rd edit., 1827, " In the irritable and sloughing state of stump that has been noticed, hemorrhages frequently take place from the small branches, or from the main trunks of the arteries, in consequence of ulceration; and it is not always easy to discover the bleeding vessel, or when discovered, to secure it on the face of the stump; for, as the ulcerative process has not ceased, and the end of the artery which is to be secured is not sound, no healthy action can take place; the ligature very soon cuts its way through, and the hemorrhage returns as violently as before; or some other branch gives way; another ligature is required, which is equally uncertain; and under this succession of ligatures and hemorrhages the patient dies. Surgeons have, in such cases, preferred cutting down upon the principal artery of the limb, in preference to performing another amputation, even when it is practicable; and they have frequently succeeded in restraining the hemorrhage for a sufficient length of time to allow the stump to resume a more healthy action. This operation, although successful in many cases, will under certain circumstances fail, and amputation become ultimately necessary; but the same objection of want of success may be made to amputation; and on a due comparison of these circumstances, I recommend the operation of tying the artery, in most cases, in the first instance; and if that prove unsuccessful, of resorting to amputation; but this practice is by no means to be followed indiscriminately. The artery is to be secured with reference to the mode of operating, as in aneurism; but the doctrines of this disease are not to be applied to it, because it is still a wounded vessel with an external opening, which truth I have more than once seen proved to the discomfiture of the surgeon.

"In the thigh the operation is less certain than in the arm, and especially if it be not the main artery that bleeds; for the branch from which the hemorrhage proceeds may come from the profunda, and tying the artery in the groin on such opinion would be doing a serious operation, and one which would probably not succeed, for the anastomosing branches would restore the circulation in the stump in a short time, and again establish the bleeding. If it is the femoral artery that bleeds, and the ligature is applied high, it is very liable to a return of the hemorrhage. To obviate these difficulties, the part from which the bleeding comes should be well studied, and the shortest distance from the stump carefully noted at which compresses on the artery command the bleeding, and at this spot the ligature should be applied, provided it is not within the sphere of the inflammation of the stump. In case the hemorrhage should only be restrained by pressure above the origin of the profunda, and repeated attempts to secure the vessel on the surface of the stump had failed, I would prefer amputation, when the strength of the patient would bear it, to tying the artery in the groin, which I do not think would be successful; and the patient would be then in a less favourable state for amputation.

"When hemorrhage takes place after amputation at the shoulder-joint, it is a most dangerous occurrence, more particularly if it occurs in consequence of ulceration. In no case is the artery to be struck at by the needle, but an incision is to be made through the integuments and great pectoral muscle, when the artery may be readily exposed, and a ligature placed upon it without difficulty anywhere below the clavicle. If the state of the stump in any of these cases depend upon the bad air of the hospital, I would expose the patient to the inclemency of the weather rather than allow him to remain in it; for I know that the effects of any exposure must be less certainly fatal to the patient than a continuance in an unhealthy atmosphere.

"It often happens, in cases of this kind, that the stump has not united, or in opening out has given rise to a protrusion of the bone, forming a conical stump, the skin has retracted, and the face of the stump, in granulating, is exposed and becomes irritable. In crowded hospitals, hemorrhage from the face of such a stump is not unfrequent, and often causes a great deal of trouble to the surgeon and much distress to the patient. It is not a direct bleeding from a vessel of sufficient size to be discovered and secured, but an oozing from some part of the exposed granulations, which are soft, pale, and flaccid. On making pressure on them, the hemorrhage ceases, but shortly after dressing the stump it reappears, and even becomes dangerous. After the battle of Salamanca, and those of the Pyrenees, I had several instances of it; there were not any at Toulouse. After the battle of Waterloo they were sufficiently numerous.

It is affirmed in France, and a statement to this effect is made in the Gazette Médicale de Paris, for the month of May, 1846, that a secondary hemorrhage, arising from inflammation, ulceration and even sloughing of a part, not only on the surface of a stump, as in the instances I have adverted to, but in an ordinary wound, such as in the calf of the leg, the principle to be pursued is to tie the femoral artery, as was done by Dupuytren in Case 42, and the reason given is that the artery is suffering already from inflammation, which has rendered its coats more (*secables*) easily divisible by the ligature, and less capable of taking on those actions which were necessary for the firm adhesion of its sides. Of this last point there can be no doubt, whence the precautions given above, to place the ligature on the artery an inch or two higher up than the part to which the inflammation or other disease had extended. The inflammation which the vessel had already suffered from would have passed that stage likely to end in the cohesion of the sides or the edges of its extremity, and the occlusion of its canal. A ligature cannot be expected to succeed when applied to an unsound artery, although it frequently will do so, for no one can estimate, a priori, the extent and nature of the disease, which may be existing in it. When surgeons write of their having felt and heard an artery crack and crunch and give way under a ligature, applied with a moderate degree of force, they must have met with vessels far advanced in disease.* When I first acted upon these principles, during the war in the Peninsula, and published them some thirty years ago, I was not aware of the extent of my own merits, and most assuredly did not expect to see my opinions claimed and recorded as those of modern surgeons in France, and opposed to what the editor of the Medical Gazette of Paris considers to be those of the best English surgeons, which, as far as I know, do not generally differ from what I have said regarding the state of the artery on the face of a diseased stump or other part which had been the seat of injury. That there is a strong inclination among a few to follow the practice recommended by the editor of the Gazette Médicale, and to tie the artery at a distance, I admit; but this I have forbidden, except as a last resource, and have, I conceive, supported with sufficient proof.

Mr. Abernethy supposed that a vessel of the size of the anterior circumflex artery, which is usually smaller than the posterior, and from which it often arises, or other vessels of even less dimensions coming off from a large trunk, would bleed with much greater vigour than others of similar dimensions, which were given off by secondary branches. He was led, I understand, to form this opinion from seeing the pertinacity with which small arteries coming off directly or nearly directly from the axillary artery, and going to small glands in the arm-pit, bled when these glands were removed by operation, in consequence of their connection with the female breast. I apprehend that arteries going to diseased or even inflamed parts do not retain and maintain their contractile powers in a similar manner to those which are going to sound parts. A change has manifestly taken place in them; they are usually larger than in their normal state, and when cut or divided pour out a larger stream of blood, and are more disposed to continue to bleed, unless nature is aided by art. Surgeons are well aware of the difficulties which are often experienced in suppressing the flow of blood from small arteries in the most distant parts of the body, such as the foot and hand, and more especially in vessels which, having once ceased to bleed, have been unable to prevent its renewal. An artery on the side of an inflamed finger will propel its jet of blood quite as far, if not farther than one of the same size in the arm-pit, and I place no reliance whatever on the supposition which, I understand, emanated from Mr. Abernethy, more particularly as it has led to another which has proved a greater mistake, and a great evil, viz., that in the event of one of these small vessels being divided half an inch or even more from the main trunk, that this main trunk must be tied, and not the branch—a practice which cannot be too forcibly condemned. Many scores of times, I had almost said hundreds, have I tied or seen tied by my direction small arteries under these precise circumstances, and with the greatest success.

In my work on the Operations of Amputation at the Hip-joint, &c., I have cautioned surgeons against an evil of this kind (p. 280, 3rd edition):—"Sometimes, after the principal artery of a limb has been secured, hemorrhage will continue from its sides above the ligature, arising in general from some branches which have been cut shorter, or have retracted more unequally than the principal trunk. Instead of puzzling at this for ten minutes, screwing and unscrewing the tourniquet, and at last diving with a needle, and laying the foundation for a secondary hemorrhage by pricking the artery, let it be transfixed, and pulled out by the tenaculum, and separated a little with the scalpel from its connections, as high as those troublesome openings, when a ligature is to be put upon it, and the end of the artery cut off with the scissors; and I never saw this ligature pushed off a large artery when properly tied. This inconvenience is in general avoided by the division of the muscles, the operator taking care to divide the principal artery at one stroke of the knife, and with it half an inch at least of surrounding substance on each side, when these small vessels will give no trouble. This is another precaution which may appear trifling, but is often of great value.

"When there is bleeding from any particular part, both venous and arterial, in larger quantity than can with propriety be overlooked, the part ought to be pressed upon by the points of the fingers, one on each side, or rather separated. The blood should then be absorbed by a small piece of sponge, when the vessel will be found retracted within the muscular fibres surrounding it, which prevent the flowing of the blood per saltum. If this fail, a slight touch with the scalpel will show the vessel, and save much unnecessary delay. I have seen the arteries of a stump occupy a person a quarter of an hour, and were not even then properly secured."

Case 87.—Mr. Stanley operated upon a femoral hernia in a man sixty-three years of age. At the time of the operation there was no unusual bleeding. About an hour after it the bandage which had been placed over the wound was observed to be soaked with blood. On removing the bandage large clots of blood were found not only filling the cavity of the wound, but also extending upwards upon the walls of the abdomen. The wound was filled by compresses of lint, and a bandage firmly bound over them. There was no return of the bleeding. On the second day after the operation the man died from peritonitis. On examining the body the obturator artery was found to arise by a common trunk with the epigastric, but it passed on the outer side of the mouth of the sac, and was therefore out of the way of injury. An artery the size of a thick sewing thread arose from the epigastric, and passed across the front of the mouth of the sac. This was divided, and it was the only artery discovered, in a careful examination of the parts, which could have furnished the profuse flow of blood that took place shortly after the operation for the hernia.

*Remarks.*—This case was supposed not only to support, but to demonstrate at the time the truth of Mr. Abernethy's views on this point, and some of the young gentlemen about the hospital announced that Mr. Stanley was about to tie the external iliac above and below the origin of the epigastric and circumflexa ilii arteries, in accordance with such opinion. Mr. Stanley was however content to apply a compress and bandage, as in ordinary cases.

CASE 88.—I performed the operation many years ago at the York Hospital, Chelsea, of removing the left testis, and tied the spermatic, the cremasteric and the deferential arteries, the three which usually bleed, and left my patient. Three hours afterwards the assistant-surgeon on duty sent a messenger to inform me that there had been some bleeding, that he had opened the wound, and that the man's bowels were coming out. Perfectly satisfied that I had made no mistake, I nevertheless went to Chelsea in some trepidation, and when the dressings were raised there certainly did appear to be a large double fold of intestine protruding to the extent of four or five inches. On further examination this proved to be coagulated blood, which, under the pressure of the external parts brought together by ligature, had simulated the appearance of intestine. On its removal the little vessel from which it came bled vigorously. It was in the integuments near the external ring, and apparently a branch of the external pudic artery coming from the thigh. A single thread of ligature settled the matter, and the man was soon discharged cured.

It is inexcusable enough to be afraid of large vessels; it is perfectly ridiculous to be afraid of small ones. In almost all cases of amputation at the shoulder-joint, the posterior circumflex artery is cut off at rarely more than an inch from its origin, frequently less. The anterior circumflex is often even shorter; yet these vessels once fairly tied never give any trouble. When secondary hemorrhage has taken place it is not recorded that the bleeding came from either of them. It has always been from the main trunk. They have remained closed, which they should not have done, if this hypothesis were in any way well founded. The operation of amputation at the shoulder-joint would be a fatal operation if not performed above the origin of these vessels, which it rarely is, and yet no great operation can be more successful. I have not within my recollection known a ligature fail on a branch half an inch distant from the main trunk of a great artery, and most certainly such an evil could not have occurred frequently without my having remarked it, as well as the inconvenience arising from their being cut somewhat shorter, on which account I have directed their removal altogether, with that portion of the main trunk from whence they sprung. I am therefore, I consider, entitled to express my disbelief not only in the hypothesis, but in what is of more consequence, in the propriety of the practice intended to be deduced from it. It would be a great error, in my opinion, implicating the limb, and perhaps the life of the individual, to tie the axillary artery for a wound of the posterior circumflex half an inch from its origin. It would be equally dangerous to tie the external iliac for a wound of the epigastric or of the circumflexa ilii arteries. It would be infinitely worse to do it for a wound of a more superficial vessel in the thigh, unless as a last resource, however close it may arise from the femoral artery. It is much to be regretted that it should be necessary to argue such points as these in 1846, which were apparently overturned and even derided in 1816. The editor of the Gazette Medicale de Paris may indeed fairly sneer at English surgery when compared with that of France if such are to be its precepta.

The axillary artery from its passage over the first rib as subclavian until it leaves the edge of the pectoral muscle to become humeral, is anatomically divided into three parts:—The first between the lower margin of the clavicle and the upper edge of the pectoralis minor muscle, which space is somewhat more than an inch in length under ordinary circumstances. The second part lies under the pectoralis minor muscle, is about the same length, and is covered or concealed by it. The third part extends from the lower edge of the smaller pectoral muscle to the lower edge of the greater, and is longer than the other two together. A vertical or perpendicular incision three inches long through the lower half or inferior border of the anterior fold of the arm-pit, in the direction of the axillary artery, would include the common integuments and the great pectoral muscle, and might be enlarged upwards if necessary, the finger being used as a director. It would completely expose the whole hollow or pit of the arm, with the smaller pectoral muscle lying across its upper part. The finger introduced under this upper part would enable the operator to divide it also if necessary, or to draw it upwards, when the artery, vein, or veins, and the plexus of nerves, might be traced up to the first rib without difficulty. The artery if open would bleed when pressure was taken off the subclavian above. With every part thus fully exposed the artery would be as easily, nay, more easily, separated from its surrounding or accompanying nerves and veins, and a ligature placed around it, than in any other way. The lower end of the cut or divided vessel might then be sought for, and secured in a similar manner.

Compare with this very simple operation the account given of that which is usually performed, taken from the best book on the subject:—

"The patient may be seated, with the shoulder of the affected side inclined backwards: an assistant should be placed behind the patient, with instructions to compress the subclavian artery in the event of hemorrhage; a semilunar incision is to be made about three inches long through the integuments, commencing about one inch from the sternal end of the clavicle, and extending towards the acromion process as far as the anterior edge of the deltoid muscle, avoiding the cephalic vein and thoracica-acromialis artery; the clavicular portion of the pectoral muscle is thus exposed, and is to be divided in the same direction, and to the same extent, as the external wound; the flap thus formed is then to be everted, and some loose cellular membrane being detached, the superior edge of the smaller pectoral muscle will be exposed; in this stage of the operation, several branches of the thoracic arteries are in danger of being wounded. A director should then be insinuated beneath the strong fascia extending from the subclavian muscle to the coracoid process, and a portion of the fascia divided. Some loose cellular membrane and a few small blood vessels being detached with the blunt extremity of a director, the axillary vein will be exposed; this vessel should be pressed inwards towards the ribs, and the artery will be felt or seen pulsating; it must be carefully detached from the nerves for a short distance, and the aneurism needle passed under it, the needle being directed from the thoracic to the acromial side. In applying the ligature, it is to be recollected that one of the large nerves of the plexus inclines to the front of the artery, and having a pulsation communicated to it, might be mistaken for the artery itself. Even on the dead body, this operation is by no means easily performed; but on the living subject it must be attended with considerable difficulty, particularly in corpulent persons: the depth at which, in such individuals, the artery lies, together with its complicated relations, must render the application of a ligature to it peculiarly hazardous. It appears to me that few cases can occur in which the operation now described ought to be preferred to that of tying the subclavian artery external to the scaleni muscles; at the same time it must be admitted, that an extensive wound passing through the pectoral muscle, may expose the axillary artery, so as to render the application of a ligature to it in this situation comparatively easy."

*Remarks.*— This description is critically and anatomically correct; no man in the united empire could do the operation better than the author of the work from which I have extracted it; and yet the operation is so thoroughly dangerous and useless, and so contrary to true principles, that it ought never to be performed. It ought to be struck out of the catalogue of operations. I know it to be dangerous, because I am aware of two persons having died under it, before the ligature was applied, the axillary vein in both instances having been injured. In aneurism from disease of the axillary artery, the operation should always be done above the clavicle; in a case of wounded artery, at the spot in which the artery is wounded below it.

CASE 89, by Mr. Quain, from the Lancet of May 2, 1846.—J. S., aged twenty-four, fell upon an iron rail which was forced into the axilla, and was admitted into University College Hospital under Mr. Quain on the 4th of March. He was faint from the loss of blood, estimated by himself at two quarts, although the bleeding had ceased. The wound, about an inch in length, was in the centre of the arm-pit, and pulsation was distinctly felt in the radial artery. On the 6th, no pulsation could be felt below the wound in any of the arteries; nor, until the 11th, when it was slightly observable in the radial artery. After this the patient gradually recovered, and was discharged, cured, on the 27th of March.

Mr. Quain stated, in a clinical lecture, that the quantity of blood lost was doubless exaggerated, and that if arterial hemorrhage had recurred he should have divided the pectoral muscle in the track of the wound, and secured the bleeding vessel above and below the opening in it.

*Remarks.*—This case essentially resembles cases No. 2 and 82. The presence of pulsation during the first two days in the radial artery, shows that the canal of the artery was not obliterated in the first instance, and that it only then became obstructed, from inflammation taking place in the brachial artery, or extending to it from a small vessel divided near its origin from it. The restoration of the pulsation in the radial artery on the seventh day after the accident shows the establishment of the collateral circulation.

The non-interference of Mr. Quain, beyond the application of a small compress and bandage, and of keeping the arm quietly supported in a sling by the patient's side, is consistent with that principle of surgery I have endeavoured to inculcate, which forbids that a man should be cut on the speculation of what may happen if he is not. If the bleeding had recurred, there would then have been a reason for interference, and Mr. Quain says he would have placed a ligature on the artery above and below where it was wounded, after having divided the pectoral muscle — an operation which would have been worthy of his high attainments in anatomy and surgery, and an example which it is to be hoped all surgeons will hereafter follow as a precept in surgery.

Let us however suppose that the external wound was not direct, and that some two or three ounces of blood had been retained in the cellular membrane under the integuments; would this have rendered an operation on the subclavian artery, above the clavicle, a preferable operation? I do not believe there is now a surgeon in England will answer in the affirmative. Let us go one step further, and suppose that the external wound had closed—a circumstance I have shown to have happened in many cases, and that a small pulsating tumour, containing three, four, or six ounces of blood, had become perceptible under the cicatrix on the day he was discharged, that is, thirteen days after the receipt of the injury — what difference would there have been in the case from the first day? The answer must be, simply in the closing of the external wound, for no one will suppose that the artery could be diseased. I shall now ask whether any one will say that the trifling circumstance of this external wound having healed, ought by any possibility to render a different operation necessary? That instead of the same simple division of the parts to expose the hole in the artery, and to tie it—an operation of no difficulty and of little danger—the deadly operation of tying the subclavian artery above the clavicle, should be resorted to. That, because the hole in the skin had healed, the patient's life was to be placed in jeopardy by an operation which has hitherto destroyed every other person on whom it has been performed. I cannot answer for what all sorts of surgeons may do, or consent to have done upon themselves, but I venture to assert that there is not a gambler existing who can calculate chances that would suffer such operation to be done on himself when those chances were fairly explained to him.

When Mr. Medhurst was tried for the murder of his friend, in a fit of passion, by stabbing him in the belly, the solicitor for the defence offered me any sum I pleased to ask to go into court, and prove that the defunct had been badly treated by his surgeons. I refused, and have invariably refused all such applications on the ground that the surgeons had done their best, and that it was not for me who had had greater opportunities of acquiring knowledge in these particular injuries, to find fault with them, who had been originally taught no better, and had not had opportunities of acquiring further information. In the treatment of wounded arteries you are now all taught better, provided you are pleased to learn, and if hereafter any of you will commit such errors as I have protested against, and so urgently denounced, I shall not refuse to give my aid in having you legally admonished.

# LECTURE V.

*Non-applicability of the Hunterian theory and operation in cases where the wounded artery cannot be seen, in consequence of the wound not being direct; Statistics of the operation for the ligature of the common iliac artery; Statistics of the operation for the ligature of the external iliac artery; Objections to the latter operation in cases of wounds of the femoral artery; case of diffused popliteal aneurism; Ligature of the femoral artery at the margin of the sartorius muscle; Secondary hemorrhage; Ligature of the femoral artery immediately below Poupart's ligament; Recurrence of hemorrhage from the seat of the first ligature; Ineffectual search for the bleeding vessel; Amputation; The artery ulcerated through; Secondary hemorrhage from the groin; Ligature of the external iliac artery; Recurrence of the hemorrhage; Ultimate cure by pressure; Remarks on the case; The theory that a ligature placed on such an artery as the femoral would fail, if in the immediate vicinity of a large branch, unfounded; The fear of fatal hemorrhage from the division of the external containing parts of a small spurious aneurism, unworthy comment; No operation should be performed on a wounded artery, until it bleeds through the external wound; Case of a wound of the femoral artery by a musket-ball; Apparent cure of the wound; Formation of a varicose aneurism; Ligature of the external iliac artery, and death from mortification; M. Delpech's case of wound of the femoral artery, with consecutive aneurism; Ligature of the external iliac artery, and death from mortification; Case of wound of the femoral artery by a musket-ball; Ligature of the external iliac artery; Death from typhoid fever; Mr. Liston's comments on this case; Dr. Buchanan's case of ligature of the femoral, inguinal, and external iliac arteries for secondary hemorrhage, consecutive on the separation of sloughs; Case of wound of the femoral artery; Occurrence of dry white gangrene; Secondary hemorrhage; Ineffectual ligature of the external iliac; Enlargement of the wound, and ligature of the lower end of the wounded vessel, with arrest of bleeding; Death from exhaustion; Remarks on the case; Should the line of demarcation in cases of mortification from wounded arteries be waited for, before amputation is performed? Place of election for the performance of amputation; Mr. Norman's case of wounded artery in the upper and outer part of the thigh; Secondary hemorrhage; Ineffectual search for the wounded artery; Ligature of the external iliac artery unavailing; Ligature of the femoral artery below Poupart's ligament; Arrest of the hemorrhage; Loss of the leg from mortification caused by the ligature of the external iliac; M. Lutens' case of ligature of the external iliac artery for a wound of the femoral some lines below Poupart's ligament; Return of the hemorrhage; Ineffectual application of a second ligature on the external iliac higher up; Incision of the diffused aneurismal swelling, and ligature of the femoral below the profunda; Death from mortification; Case of wound of the femoral artery in the lower part of the upper third of the thigh; Formation of a large diffused aneurism; Ligature of the femoral artery below Poupart's ligament; Secondary hemorrhage; Ligature of the external iliac; M. Jobert's case of ligature of the femoral artery below Poupart's ligament, for a diffused aneurism of the same artery under the sartorius muscle, caused by a wound; Death from repeated hemorrhage; Dr. Portal's case of hemorrhage after an operation in the groin; Ligature of the external iliac; Return of the hemorrhage; Ligature of the femoral artery and vein at the site of the wound; Arrest of the hemorrhage; Death from peritonitis and gangrene; Dr. Murray's case of aneurism from a blow; Ligature of the femoral below Poupart's ligament; Violent secondary hemorrhage; Ligature of the external iliac; return of the hemorrhage from the lower part of the injured vessel; Cure by compression; Baron Dupuytren's case of femoral aneurism from a blow; Failure of compression; Ligature of the external iliac artery; Return of pulsation in the aneurism on the eighth day; Secondary hemorrhage from the lower end of the wound; Ligature of the iliac artery higher up; Return of the hemorrhage; Cure by compression; Remarks on the case; Case of wound of the inguinal artery; Ligature of the upper end of the wounded vessel; Fatal secondary hemorrhage; Case of ulceration of the external pudic artery, following a sloughing bubo; Secondary hemorrhage; Application of the actual cautery and pressure; Return of the hemorrhage; Extension of the ulceration to the femoral artery; Ligature of the external iliac artery; Symptoms of mortification; Successful amputation close to the trochanter; Dr. Warren's case of secondary hemorrhage after amputation of the thigh; Ligature* *femoral artery; Return of the hemorrhage; essful ligature of the femoral artery an inch Poupart's ligament; Case of femoral aneu- opened by mistake; Amputation, and death; of inguinal aneurism opened by mistake; ture of the external iliac artery; Fatal gan- ; Remarks on the case; Case of inguinal rism, extending under Poupart's ligament; essful ligature of the external iliac artery; h eight years afterwards; Mr. Canton's ana- al description of the collateral vessels; Dr. er's case of ligature of the external iliac artery inguinal aneurism; Incision of the sac, and val of the coagula, followed by formidable rrhage; Division and ligature of the femoral y below the sac; Hemorrhage from the upper f the artery, and application of a ligature on essation of the hemorrhage; Death from in- nation and suppuration behind the peritoneum external iliac artery, up to and behind the kidney; Probable source of the hemorrhage the branches of the profunda, with those of ternal iliac, and from the epigastric and cir- lexa ilii; Remarks on the case; Dr. Horner's of varicose femoral aneurism from a pistol- ; Ligature of the femoral artery at the in- part; Mortification of the leg, for which tation was performed; Consecutive formation aneurism at the extremity of the artery; ture of the sac; Consecutive hemorrhage, ted by the application of several ligatures nd the sac; Fatal recurrence of mortification; Brainert's case of inguinal aneurism follow- fracture of the femur; Successful ligature e external iliac.*

vo women who had each borne a living child ap- d before Solomon on the death of one of the chil- , each claiming the survivor as her own. The t lawgiver, unable to decide in the first instance h was really the mother of the living infant, ed that it should be divided by the executioner, that half should be given to each of the claim- . To this the false parent acceded, but the one, impelled by that affection which is so ral to a mother, gave up her right and her child r than it should be sacrificed. Solomon, thus aware of the real parentage of the infant, ded the child to her who had shown herself so ly interested in its welfare. I am in the posi- of the real mother with relation to the treat- of wounded arteries. It is now conceded, I ve, by all English surgeons that when an artery en bleeding in the bottom of a wound, that two ures ought to be placed upon it, one above, the r below the injured part. It is however at- ted by some few to maintain a part of the terian theory and practice, by affirming that the artery cannot be seen in consequence of wound not being direct, although it bleeds, or pposed to be about to bleed, or to form a ious diffused traumatic aneurism, having an rnal opening, this theory and practice may be ted in its treatment. Its advocates, beaten from their first claim of the whole of the theory, are now reduced to contend for half, or for even a part. I cannot however yield them one single point. I totally deny the justice of every part of their claim, and declare without hesitation that the operation of tying the external iliac artery for a wound of the femoral must in general be not only ineffectual, but often fatal; and that if a person should escape with life and limb, he only escapes by that sort of accident which every one acknowledges to have been most fortunate, when a man in a gale of wind is carried off the deck of his ship by one wave of the sea, and is thrown back by another—a consummation always to be desired in such cases, but rarely to be expected. One party is right and the other wrong. It is a point upon which there can be no compromise. The life of man is in the mean time the shuttlecock of these contentions. The profession can decide this point, and its voice should be heard. It should, like Solomon, decide for one or the other.

The operation of placing a ligature on the common trunk of the iliac artery has been performed certainly fourteen times, and has succeeded in six instances—a success which would have been considered as really wonderful, as the operation would have been thought to have been impracticable some three score years ago. In two of the eight the peritoneum was necessarily opened, and they may be fairly omitted in the calculation of averages; so that the proportion of recoveries to deaths was equal, six to six. Of the six deaths four were from hemorrhage, and two from inflammation of the peritoneum and of the cellular membrane behind, as high up as, and around the kidney. The fourteen operations were performed by Messrs. Gibson, Mott, Crampton, Liston, Guthrie, Salomon, Syme, Deguise, Perigoff, Post, Stevens, Peace, Stanley, Hey—six American, five British, one French, and two Russian or German surgeons.

Mr. B. Phillips has shown the mortality in eighty-six cases of ligature of the external iliac artery to be twenty-one, or one in four. The deaths in proportion to the recoveries are only one-fourth as great as in the operation on the subclavian artery, and are as nearly as possible equal with respect to others which have been performed for all sorts of cases on the femoral artery at the lower part of the upper third of the thigh. There is no objection, then, to the external iliac artery being secured by ligature in cases of aneurism of the femoral artery, for which complaint it has been principally done, on the score of greater danger. The principal objections to it in the case of a wound of the femoral artery are—

1. Its inefficiency, in consequence of the bleeding being renewed from the wound in the artery at the moment, or after the interval of one or more days, by the restoration of the circulation in the vessel, through the medium of the collateral branches.

2. The occurrence of inflammation of or behind the peritoneum.

3. The greater probability of mortification of the extremity after the operation on the external iliac

artery than on the femoral, but which, I trust, may hereafter be materially obviated by the continued gentle friction on the leg and foot, which I have recommended as so beneficial.

The femoral artery high up in the thigh, or in the first three or four inches of its course, is the stronghold of the Hunterian theorists. They have made their last stand on this part, and on this their principle must be approved and maintained, or condemned and abandoned. Their grounds of defence are two:—

1. That this is a part of the vessel on which the application of a ligature is not usually followed by success, owing principally to the uncertain origin of the profunda artery which is given off by it somewhere within this distance.

2. That an operation to divide the parts which cover the artery, in order to expose the wound in it, might lead to the death of the patient from loss of blood.

The hypothesis that the upper part of the femoral artery is a very dangerous and unsafe part on which to apply a ligature, originated I believe with Mr. Hadwin, late house-surgeon of the Leicester Hospital, who published a case of Mr. Hewson's, one of the surgeons, through Mr. Quain, in the 20th volume of the Transactions of the Royal Medical and Chirurgical Society, on which, and on the inferences drawn from it, Mr. Quain seems to rely, for the opinion he supports, that the external iliac artery should be secured by ligature in preference to the femoral artery at the part wounded.

CASE 90.—A man was admitted into the Leicester Hospital on the 18th July with a popliteal aneurism, which had probably been ruptured, so as to become in fact diffused, for which the femoral artery was tied at the margin of the sartorius muscle. On the 30th, bleeding occurred from the wound to eight ounces. Pressure was applied. On the 31st, the bleeding returned with such violence that the femoral artery was tied immediately below Poupart's ligament. The pulsation at the seat of the first ligature ceased, but in the evening there was a slight oozing of blood from the first wound.

Aug. 2. Bleeding recurred from the same spot; was arrested by pressure, but as soon as it was removed blood flowed in a stream as large as a quill. The wound and partial cicatrix were laid open, and an ineffectual attempt was made to find the mouth of the bleeding vessel. The limb was then amputated above the lower ligature, which was found on the lower end of the artery, which was quite separated from the upper end, the mouth of which was open.

On the 21st the wound in the groin was observed to bleed, and was arrested by compression; it again recurred, and on the 22nd, on its being renewed, the external iliac artery was tied. On the 28th the wound at the groin again bled. It was not thought right to tie the iliac in another place, and the pressure which had failed before was again resorted to, and with success, the patient being discharged on the 101st day.

*Remarks.*—The artery diseased, in all probability as high as the external iliac, was incapable of taking on healthy actions. The first ligature applied did not succeed in obliterating its canal, because these healthy actions could not take place in a diseased part. The second ligature below Poupart's ligament failed for a similar reason. The third, placed higher up, succeeded, the artery being in a more healthy state, as it usually is in cases of aneurism of the femoral artery. The point in this case most worthy of notice, and to which particular attention should be paid, is the manner in which the collateral vessels brought the blood round into the main trunk of the limb, and re-established the circulation in it, reducing the extremities of the vessels from which each of the ligatures had come away to the state of wounded vessels, although another ligature was still on the same vessel above the part which bled. This person's life was at last only saved by pressure on a bleeding point or end of the artery, the ligature above being unequal to prevent or arrest the flow of blood from it. The conclusion which Messrs. Hadwin and Quain appear desirous of drawing from this case, as regards wounded and otherwise healthy arteries, is overthrown and disproved by the case itself, which actually shows the imperative necessity of tying arteries that bleed as near as possible to the bleeding points, and that a ligature placed above or at a distance is unequal to restrain the blood from flowing through an open extremity lower down, in consequence of the facility with which the collateral vessels, in many instances, re-establish the circulation below the ligature. That a ligature placed on an unsound artery should fail of success, is what every surgeon must expect. That it should fail at this spot, not because the artery was unsound, which was the fact, but because the profunda artery originated somewhere near it, is merely hypothetical and unphilosophical, one good reason being usually considered sufficient, without the aid of another of a very uncertain character.

I affirmed in 1815 that there was no foundation for the theory which declared that a ligature when placed on an artery such as the femoral would fail, if in the immediate vicinity of a collateral branch, in consequence of the flow of blood through this vessel preventing the obstruction and consolidation of the main trunk for a distance sufficient to enable it to resist the impulse of the blood from behind. It is a delusive theory, hastily formed, and pertinaciously retained contrary to observation and experience. The observations I have before made in Lecture 4 overthrow it in a manner which is perfectly irresistible, independently of the many other instances in which the same facts have been known to take place.

The origin of the profunda is easily ascertained during an operation, provided it is within half an inch of that part of the main trunk on which it is intended to apply a ligature; and it having been ascertained that it is not within this distance, the surgeon need give himself no more concern about it, more especially when the arteries are all sound, as is usually the case when they are accidentally wounded.

It will be proved in the cases which follow, that when a ligature is placed or has been placed on the external iliac artery, it is frequently applied in a similar situation with respect to the orifices of the circumflexa ilii and epigastric arteries. These vessels are not invariable in their origin; it differs in many instances; the ligature is generally placed between them, and at an unknown distance from either. The theory of the danger arising from the proximity of the origin of a branch is as good in one case as in the other; the actual danger, whatever it may be, is as great. The objection in one instance is quite as good, and no better than in the other, and it is, in my opinion, practically worth little or nothing in both. The essential point is that the artery in aneurism is more sound when iliac than when femoral. The soundness in wounded arteries is alike in both, and a ligature is as little likely to fail in one as in the other, whilst the danger of peritoneal inflammation does not exist when the ligature is applied to the femoral artery, and that from mortification of the extremity is infinitely less. If the ligature of the femoral artery should fail, as well as pressure properly applied, the iliac artery becomes a further resource. Mr. Key has shown in the Guy's Hospital Reports, in a case in which the subclavian artery was tied above the clavicle, and which he had the opportunity of dissecting twelve years afterwards, that the ligature was actually applied close to the origin of a large branch from the subclavian artery, and that it had not interfered with its consolidation; and I should think that, if these observations are duly considered, with the remarks I made on this point in my last lecture, the theory may fairly be considered as worthless with regard to wounded arteries.

In every case I have related or shall relate the loss of blood is stated to have been considerable at the moment of injury, but no reliance can be placed on the computation usually made as to the quantity. Operations were rarely done in any of these cases until rendered absolutely necessary by further losses of blood after repeated hemorrhages, and as to the fear said to be entertained of dividing the containing external parts of a small spurious aneurismal swelling, in order to look at the hole in the vessel, lest it should bleed so as to destroy the patient, it is totally unworthy of a comment. I cannot understand how any one can entertain such an apprehension. If it had not been advanced as a reason by men of undoubted ability, I should have looked upon it in these days, and after what has been done in all quarters of the globe, as an acknowledgment of incapability or imbecility; as it is, it is only, in my humble opinion, a bad reason put forward in a worse cause for the want of a better. The great principle of surgery on this point must never be forgotten, that no operation should be done until the wounded artery bleeds through the external wound, and then it becomes imperative. It must then be done on the spot, aye, and even if the iliac artery had been previously tied, or the patient will be lost.

Case 91.—A soldier of the 38th regiment was wounded by a musket ball at the battle of Waterloo, which entered the thigh about three inches below Poupart's ligament, and lodged. He lost a considerable quantity of blood at the time, but the wound healed kindly, and he was discharged, cured, in about four weeks. On the 18th of August, two months after the receipt of the wound, he complained of a tumour, about three inches in length and two in breadth, which extended to within an inch of Poupart's ligament. The pulsation was powerful, and gave the feeling of a strong thrill with considerable resistance to the propulsion of blood. The cicatrix of the original wound was situated upon the tumour towards its upper part. It was deemed expedient to place a ligature on the external iliac artery on the 28th of August, and the man died on the 1st of September of mortification, which had extended to some three inches above the knee. The operation was performed with great dexterity, and no evil had resulted from it at the part operated upon. The ligature was on the artery *a quarter of an inch above the origin of the epigastric, and about an inch below that of the circumflexa ilii.* A small communication was found between the femoral artery and vein at the side of the tumour, about an inch and a half below the origin of the profunda. The covering of the aneurism was formed by the sheath of the vessel and the fascia of the thigh. The profunda was sound. The whole limb was in a state of gangrene.

*Remarks.*—The operation on the external iliac artery was done on the aneurismal theory of Mr. Hunter, and the man lost his life from mortification, the collateral branches not having had time to enlarge so as to carry on the circulation. If the small tumour had been laid open and the artery secured above and below the opening in it, mortification would not, it may be presumed, have taken place. The opening in the vein, if it became necessary to operate upon it, should have been closed by passing a tenaculum beneath its cut edges, and surrounding the small piece thus bruised by a single silk thread, which on separating need not necessarily have destroyed its permeability. Three or four days would at all events have been gained before any bleeding would have taken place, in which case a ligature might have been placed around the vein, and the collateral arterial circulation might by that time have been established. This case teaches the important lesson, that when an aneurismal tumour is rapidly formed after an injury, and operated upon at an early period, the collateral branches will not always have had time to enlarge to such a degree as to carry on the circulation, and the patient is lost, when a little more delay and a different operation might have been attended with a favourable result, the artery itself, with the exception of the hole in it, being sound. It is now admitted, when the vein is wounded and a varicose aneurism forms, that the operation must be done at the part injured.

Case 92.—M. Delpech about the same time, July 15, 1815, tied the external iliac artery for an aneurism similarly situated. The patient died from mortification.

Case 93.—Osten Cooper, of the 2d battalion 1st regiment of guards, thirty years of age, was wounded at the battle of Waterloo, on the 18th of June, by a musket ball, which entered the left groin a little below Poupart's ligament, passed through the thigh, and was cut out the following day a little above the smaller trochanter. Nothing remarkable occurred until the 29th, when the slough from the anterior wound came away, and was followed by so frightful a hemorrhage as to leave no doubt whence it proceeded, nor (from the wound being so high up) any alternative in the opinion of the surgeon as to the means to be adopted for stopping it. The external iliac was therefore exposed, secured by a double ligature, and divided; the ends of the artery immediately retracted more than half an inch. The sides of the wound were then brought together by adhesive straps, and the operation was finished without loss of blood. Arterial action was so high, that twenty ounces of blood were taken from the arm; the limb was rolled in flannel, and warm jars kept to the foot.

*Remarks.*—This man died on the 5th of July, seven days after the operation, of fever of a typhoid character then endemic in the country, and which from the second day left little hope of recovery. The operator in concluding his statement, which I published at length in my book on the Diseases and Injuries of Arteries, says, "In this case the necessity of the operation is evident, and, as far as it went, also its success. Not a drop of blood was lost after it. That the patient died from intermittent fever running into the continued form, and that of the typhoid type (induced probably by loss of blood), no one who has observed the endemic disease of this climate will be inclined to doubt." Mr. Liston, in supporting the practice he pursued in the case of Mr. Seton by precedents, has adduced in a particular manner this one of Osten Cooper from my book (according to the report of the three weekly medical journals), and has erroneously attributed the above remarks to me; adding, after transcribing the last, "So says Mr. Guthrie, who it is to be presumed conducted the treatment of the patient." I do not object to Mr. Liston having made use of me in this way. I must be permitted, however, to say in my turn, that I never saw the man nor knew of the operation until the case was sent to me by the staff surgeon who did it. I published it in the midst of several cases showing the impropriety of such an operation, and in a part of my book in which it is said I criticised Baron Dupuytren rather sharply for recommending a similar practice. It is my duty, however, to express the great regret I feel at having so misled Mr. Liston by my negligence or by my delicacy towards my old friend the operator, as to have caused him to misconceive my meaning, and I consider myself justly liable to bear a large proportion of the blame of any evil which may have been occasioned by them. In thus acknowledging the error I unintentionally committed, I am the more bound on this occasion to make my meaning so plain that it cannot again be misconceived. I shall therefore say, that if this man, Osten Cooper, had not died of fever, he would in all probability have died from a recurrence of the hemorrhage from the original wound, in consequence of the right operation of tying the artery having been done in the wrong place, and where it could be of no use unless by accident.

On the peace of 1814 being made, I was placed on half pay, with a month's notice to quit, somewhat like a turned-off footman, and was obliged to seek for other employment. The hundred days of Napoleon found me trying to establish myself in London. I had placed my all on the hazard of that cast, and I was obliged to await the result. Three general officers, high in rank, requested me to accompany them on service, and to live with them during the campaign of Waterloo. My old and kind friend Sir James M'Grigor, then just appointed director general, offered to place me on full pay for six months; I would willingly have served for three, but that would have been thought a job,—that the service had been made use of to favour my views. I therefore went to Brussels and to Antwerp, like other amateurs, without rank, pay, or any appointment. The whole of the medical officers received me as no other person had ever been received: they all said, we know your object, and everything we have in our charge is at your disposal; we will do everything you wish, and do you what you please. I visited the severest cases only. There was not a mother, wife, or sister of a badly wounded officer at Brussels whose knees were not bent to me, not a father or a brother whose hat was not off and down to the ground. I was as poor as a rat in those days, but my opinion was not to be purchased; no one presumed to think of such a thing; now that I am not so poor a man, and my opinion may be more valuable, every one thinks he does me a favour who gives me one or two guineas for it. Perhaps it may be so. I was then however more gratified in working for nothing than I now am for money. All the senior officers of hospitals offered to send to London any of their bad cases that I could obtain permission to bring over. I did two operations only at Brussels and none at Antwerp. One an amputation at the hip-joint, the second the operation related in Case No. 50, and a third man was sent after me, who had a ball rolling about in his bladder, whom I afterwards operated on successfully in the York Hospital, Chelsea. A large body of military and medical staff officers were present to see me remove the ball, which had become encrusted and formed a stone. The Duke of York visited this man, and took so great an interest in him, a German, and in the Frenchman whose thigh I had amputated at the hip-joint, as to obtain for both pensions, and for the latter a place in the Hotel des Invalides in Paris, where he was for many years the only living instance of a successful operation of the kind. Two large clinical wards were given to me, on my return from Brussels, by Sir James M'Grigor, for two years, on the same terms, viz., that I did the duty without any remuneration whatever. These were filled with the worst and most interesting cases my friends could send to me, not only from Brussels and Antwerp, but latterly from Harwich, Colchester, and Chatham. They were given for the purpose of enabling me to deliver those lectures to the officers of the public service with advantage, which I continued for five-and-twenty years, and of which those I am now giving are only a continuation. It will now be readily understood why I could not publicly find fault with any of the gentlemen who had behaved so kindly to me, and particularly with the surgeon of Osten Cooper; and you will observe in these lectures, that wherever I have not approved of the practice pursued in any case by my contemporaries, I have rarely named the surgeon in charge of it. I want merely the fact for the benefit of science, not the inculpation of an individual.

If, under these circumstances, I sometimes address you more dictatorially and magisterially than may appear befitting, I will beg of you to bear in mind that on many of the points in question I have had greater opportunities of acquiring information than most persons now living, and I may be permitted to add the expression of my regret that I should have made comparatively so little use of them. On many of the great occasions to which I have alluded, there was scarcely time for a remark, much less for written notes to assist the recollection.

I have given you this slight sketch of things long since passed away, that you and others whom I sometimes annoy by my representations, may be aware why I interest myself on all occasions in favour of the wounded soldier, his medical attendants, and the reputation of the surgery of the public service; that you may also know that all the favour which ever has been shown me has been to give me opportunities for good hard work, and for which I was then thankful and am now grateful. With respect to advancement, emolument, or rank, I hold the same rank and station and have the same half pay I was entitled to in 1812, when I had the charge of two-thirds of the British army under Lord Hill opposed to Marshal Soult in front of Madrid.

Case 94.—Dr. Buchanan relates the case of a boy in the 5th vol. of the *Glasgow Medical Journal* for 1832, p. 151, who suffered from hemorrhage, which caused him to do the operations of tying the femoral, inguinal, and external iliac arteries. The boy had been injured on the 15th January by the wheels of a rail-waggon, which caused a mortification of the skin and subjacent tissues of the upper part of both thighs, and of the lower part of the abdomen. The ulceration left on the separation of the sloughs contracted into a deep unhealthy looking hollow in the left groin, which had partly filled up, and he was gradually becoming convalescent, until eighteen days after the accident, when hemorrhage to the alarming extent of thirty ounces took place, and only stopped on the boy's fainting. A coagulum formed over the part whence the blood came, and the femoral artery could be felt immediately below it in the hollow alluded to. From the state of great depression into which he fell he had gradually recovered during the three subsequent days, when a second bleeding took place to the extent of a pound, issuing from a small aneurismal pouch, about the size of a field bean, in the centre of the soft flabby ulcerated hollow in the left groin. The hemorrhage was restrained by compression with the finger on this spot, and all operative process was deferred in consequence of the great state of exhaustion of the patient, from which he again recovered. Nine days afterwards a slight bleeding recurred, and was easily arrested.

On the 26th of February, or forty-two days after the accident, bleeding again took place to the amount of two ounces, and was arrested by compression with the finger. The wound being minutely examined in consultation, the compress was removed, and a gush of arterial blood followed, which was at once stopped by the finger. It appeared to come from the femoral artery, which, with its sheath situated in the hollow before referred to in the groin, seemed to be in a soft and friable state. The external iliac artery was then secured by ligature, and the bleeding ceased. No pulsation could be felt next day in the left femoral or popliteal artery. Four days after the operation, or on the 2nd March, at seven in the morning, bleeding again took place from the same spot as before to the extent of an ounce, the patient stopping it himself, although it returned at two different periods before two o'clock on attempting to remove the finger from the hemorrhagic spot. Suppression of bleeding and pulsation was effected by compression of the femoral artery on the distal side of the place whence blood issued. The femoral artery below was tied, but in vain, for the hemorrhage recurred with equal violence on the removal of the compression made by the finger over the bleeding spot. It was then thought right to place a single silk thread ligature on the inguinal artery immediately above the bleeding point, underneath Poupart's ligament, on tightening which the pulsation and hemorrhage were instantly arrested. On the 6th, or four days after this operation, pulsation could be detected in the popliteal artery. On the 15th the boy died from exhaustion, the effect of a large abscess on the ilium and sacrum, the surgical wounds being nearly healed. The ligatures on the femoral and inguinal artery, applied on the 2nd of March, came away on the 12th.

*Remarks.*—The ligature on the external iliac was useless, and should not have been applied, as it did not prevent the collateral branches, and principally the epigastric and circumflexa ilii arteries, from restoring the hemorrhage through the inguinal, the ligature on which alone was really efficient, and ought to have been applied in the first instance. The ligature below the wound in the femoral artery would in all probability have become necessary, even if this had been done. This case is one of the best possible proofs of the soundness of the principle that a wounded or injured and bleeding artery is to be tied *immediately* above and below the seat of injury, and not at such a distance as admits, as in this case, of intervening branches restoring the circulation.

Case 95.—A gentleman received an injury in the upper part of the left thigh, parallel to, but some little distance below Poupart's ligament, from having ridden against the shaft of a van. The late Messrs. Heaviside, Howship, and Chevalier were sent for immediately, and my assistance was desired next morning. I called the attention of these gentlemen to the tallowy-white and mottled appearance of the foot and lower part of the leg, as indicating the loss of life from a deficient supply of blood, and assured them that the femoral artery, and probably the vein, were injured. In the mortification they would not believe, until it became too obvious as a case of dry white gangrene, the foot and leg shrinking and drying, whilst the course of each of the tendons on the instep and toes was marked by so many dark red lines. Amputation of the mortified part they would not hear of; they thought me (it happened many years ago) remarkably wild in my ideas, and as I was only a consultant, I yielded. On the eighteenth day after the accident blood flowed from the wound in an alarming quantity, and of a dark venous colour. This I pronounced to come from the lower end of the artery. My friends thought me a little more wild than before, and as the wound was so near Poupart's ligament, they proceeded, in spite of all my remonstrances, to tie the external iliac artery, which did not stop the bleeding. As I had predicted that it would not do so, they now began to think I did know something about the matter, and desired me to do what I pleased. I therefore enlarged the original wound in the thigh, sought for the lower end of the artery, which the dark flowing blood readily pointed out, and secured it by the ligature. The bleeding ceased, but the man died exhausted some days afterwards.

*Remarks.*—This is a remarkable case, and which I did not think it right to make known in its details during the lifetime of either of the surgeons concerned. There were nothing but errors committed in its management, simply because my colleagues knew little or nothing about the matter. They had not seen anything of the kind. Mr. Heaviside was too old to yield. Messrs. Howship and Chevalier were incredulous, and I was then too young to command that confidence which my knowledge authorised. The operation which ought to have been done on this man was to have enlarged the wound, and have tied the femoral artery at the lower part, from which it bled. The upper end would in all probability have given no trouble, and it would have been easily secured, if it had. The theory of aneurism, and the desire to do an operation then rather uncommon led to the ligature of the external iliac, and so signal an exposure of the failure of the theory, and its inapplicability in such cases ought to be convincing, whilst the propriety of, and actual necessity for, seeking for the divided and bleeding artery are made equally manifest. The remaining surgical point is yet, although near thirty years have passed away, of more importance still. The essential surgical question to be asked is, what ought to have been done with respect to the mortified limb? The followers of Mr. Hunter, as well as most modern surgeons will say, wait for the formation of a line of separation, and then amputate the leg. My reply is that the man did not live long enough to see that day, and that in such cases men never will live long enough for it to take place, and that as early an amputation as the recognition of the mortification will permit should be had recourse to. A more important question yet remains. At what part ought the limb to have been amputated in this case, and in other cases of a similar nature?

In Case No. 24, or that of Turnbull, I desired the limb to be cut off below the knee. I should have done the same in this case. The principle on which it is done I have pointed out in my work on Gunshot Wounds, with reference to the distinction between constitutional and local mortification. The mortification in both these cases was for the first two or three days almost entirely local, and the amputation would have succeeded at that time, before the constitution became implicated. By doing it below the knee, that joint would have been saved, and the collateral circulation would have been sufficient to preserve the life of the thigh between the knee and the wounded part of the artery, the profunda femoris being intact. It may be said that a greater security would be obtained by amputating the thigh at the wound, and this would be the best mode of proceeding if amputations so high up were not generally unsuccessful.

Case 96.—In this case, published by Mr. Norman in the 10th vol. of the Medico-Chirurgical Transactions for 1819, John Lacey, a boy fourteen years of age, was wounded on the 21st of August by a pitchfork on the upper and outer part of the thigh, which bled profusely at the time, and slightly on several occasions afterwards, until the 29th of September, when the bleeding was so profuse that it was thought right to endeavour to find the bleeding artery. An incision seven inches long was made, but the artery could not be discovered on removing the coagula, although an immense flow of blood followed their removal. As pressure on the groin arrested the hemorrhage, when the hand was passed into the cavity which had been laid open, and the finger within it reached the spot where the assistant compressed the artery in the groin, Mr. Norman tied the external iliac artery. This did not stop although it diminished the bleeding, and Mr. Norman therefore tied the femoral artery below Poupart's ligament, and completely and finally arrested the hemorrhage. This boy at last recovered with the loss of his leg from mortification, which appeared six days after tying the external iliac; the limb was amputated above the knee.

*Remarks.*—Mr. Norman says plainly that the hemorrhage was arrested by the ligature below Poupart's ligament, and not by that on the iliac, which was therefore useless, and by giving rise to the mortification placed the boy's life in the greatest jeopardy. The amputation above the knee, and not as high up in the thigh as the wound, is the crowning point of this remarkable and most conclusive case.

Case 97.—M. Lutens (*Gazette Médicale*, 1842) placed a ligature on the external iliac artery in consequence of a wound of the femoral artery, some lines below Poupart's ligament, which had bled several times. The ligature having been applied during hemorrhage, the compress on the bleeding part was taken off as soon as it was tightened, when the hemorrhage returned as furiously as before, on which a second ligature was placed on the external iliac higher up, which failed equally in arresting the bleeding. It was now manifest that the epigastric and circumflexa ilii arteries poured their blood into the open femoral artery by regurgitation, and that the extremity of this vessel must be secured. To do this M. Lutens laid open the diffused aneurismal swelling, and after overcoming great difficulties tied the femoral artery below the origin of the profunda. A stream of blood still flowed from the wound, but was stopped by cold water. Mortification of the leg followed these operations, and the man died. On dissection it was found that the first and second ligatures were placed above the origin of the epigastric and circumflexa ilii arteries. The last was placed below the profunda, so that three vessels entered into the artery between the ligatures, and brought blood collaterally into it, two above and one below the opening made by the point of the sword.

*Remarks.*—It was utterly impossible for either of these ligatures to have suppressed the hemorrhage, unless these three communicating branches should have failed to bring blood into the main trunk from their collateral communications—a result which no educated men can reasonably have a right to expect. This case proves, in an incontrovertible manner the impropriety in the first instance, of placing a ligature on a wounded artery anywhere else than on the wounded part.

Case 98.—Bonnet was struck in a quarrel by a knife in the lower part of the upper third of the thigh, which was in vain attempted to be arrested by compression, under which a large diffused aneurismal tumour formed. The femoral artery was tied immediately below Poupart's ligament. Twenty-seven days afterwards, and seven days after the ligature had been detached, the patient walked down stairs, and brought on a bleeding, which was stopped by compression, but returned on the third day. Again arrested by the tourniquet, it returned two days afterwards. The surgeon then decided upon tying the femoral artery above the origin of the profunda. In doing this he introduced his finger into the hole whence the bleeding came, and thus arrested the hemorrhage. Disappointed in finding the situation of the profunda, he proceeded to tie the external iliac. The bleeding was then finally restrained, and the patient recovered.

*Remarks.*—The first ligature was applied after the method of Anel, and above the profunda, through which it is possible blood was brought back into the wound. When the supply from the epigastric and circumflexa ilii arteries was cut off, the hemorrhage ceased. Accident alone prevented its renewal, for the bleeding would certainly have returned if the collateral vessels had been very active, whilst the life of the limb was greatly endangered by the supply of blood through them being cut off.

Case 99.—M. Jobert, in the Hospital St. Louis, at Paris, tied the femoral artery an inch below Poupart's ligament, and above the profunda for a wound in the femoral artery where it lies under the sartorius muscle, and had formed a diffused aneurism. On the seventeenth day the patient died after four hemorrhages from the end of the tied artery, proving the insufficiency of the distant ligature with such an intervening branch as the profunda femoris. —*Gazette Medicale*, 1839.

Case 100.—Dr. Placide Portal, of Palermo, removed some enlarged glands from the groin. Secondary hemorrhage followed, and the external iliac was tied above the epigastric artery. The third day the bleeding from the wound returned, and a ligature was made to surround the femoral artery and vein at the bleeding point. The bleeding ceased, but the man died of peritonitis and gangrene of the limb, caused by the useless operation on the external iliac artery.

Case 101.—A gentleman, thirty-nine years of age, struck his thigh with the end of a fowling piece between the upper and middle third parts, and two months afterwards perceived at this spot a small but strong pulsating swelling, which gradually increased in size. At the end of twelve months it extended from within an inch and a half of the crural arch to where the artery passes through the triceps muscle. It had an elevation of three inches, and could not be covered by two hands laid over it. A ligature was placed by Dr. Murray on the femoral artery, at about an inch below Poupart's ligament, on the 20th of September (the operation of Anel). During the first fortnight he suffered most distressingly from flatus in the intestines, which was only effectually relieved by the introduction of Dr. O'Beirne's tube into the rectum. On the fifteenth day after the operation violent hemorrhage took place, to the extent of three or four pounds, and he seemed to be about to die. A ligature was then placed on the external iliac artery, and the bleeding ceased, which it had indeed done under pressure upon the bleeding part before the ligature was actually tightened. On the fifteenth day after this second operation, on the 27th of September, bleeding again took place to the amount of three pounds from the first wound made in the groin, from which it flowed, not by jerks, but in a continued uniform stream, although of a red colour, and was restrained by pressure made below on the side of the aneurism, showing that it came from the lower end of the vessel. Pressure by graduated compress was made upon this part, and steadily kept upon it by bandage; the bleeding did not return, and the patient ultimately recovered.

*Remarks.*—Dr. Murray acknowledges that the first bleeding came on, in all probability, from the same place as the second, and that the ligature on the external iliac artery was unnecessary, although he strongly recommends that the external iliac should be tied in such a case in the first instance, and being one of aneurism of twelve months' standing, after a blow which might cause disease in the artery to some distance, he is certainly right in his recommendation. If, instead of being a case of aneurism from a blow, it had been one of a wounded artery, or of a diffused aneurism communicating with a wounded artery and an open wound externally, tying the external iliac would have been of no use. Compression could not have been so readily made, and an operation for securing the vessel at the part injured must have been done. Would any surgeon with an open wound in his own femoral artery an inch and a half below Poupart's ligament feel satisfied with having his external iliac artery tied, trusting to pressure on the wound to prevent hemorrhage? He would fear that both ends of his femoral artery might bleed through the hole in the side of the vessel, and that a ligature would be ultimately necessary above and below it, proving that he had run the risk of the ligature on the external iliac artery for nothing.

Case 102.—T. Berger, aged forty-five, struck his groin with the end of a plank, and two months afterwards discovered a tumour the size of a hazel-nut, about two inches below the crural arch. A year afterwards, having made a violent exertion, the swelling increased to the size of a hen's egg, and soon after became larger. Compression was employed in vain, and on the 16th of October Baron Dupuytren tied the external iliac artery. On the eighth day afterwards, the circulation was established in the limb, and pulsation was felt and seen in the tumour. On the ninth the swelling was diminishing in size, but the pulsations were more distinct. On the twentieth day they were quite sensible to both touch and sight, and on the same day hemorrhage occurred from the wound. It was repeated on the second day, was arterial, and apparently from the lower end of the wound. The iliac artery was tied again higher up, and the pulsation in the tumour ceased for six days. It then returned, and it was plain that the blood which flowed did not come from the end of the artery which had been tied, but from vessels placed between the ligature and the ventral aorta; and what vessels, the Baron asks, could it be, unless it were the internal iliac and the internal mammary. By what trunk was it that the blood was conveyed to the aneurismal sac? The femoral artery presented no pulsation below the tumour, and compression appeared to increase rather than diminish it. Was it by the profunda? The position of this artery behind the tumour rendered it difficult to say. Was it, in fine, by the epigastric artery? The double communication of this vessel with the substernal and obturatrix is well known; nor is it a rare thing for a very considerable arterial branch to extend from one to the other of these arteries. This idea induced him, he says, to examine carefully the course of the epigastric artery, and it was with no small surprise that he felt strong pulsations along its course, even through the thickness of the abdominal parietes, and especially in the vicinity of the tumor. It seemed probable, therefore, that the epigastric artery was the principal agent in restoring the pulsations to the tumor, and that in this case, as it happens sometimes after tying the primitive carotid, the very facility of communication, so far from favouring the cure, was the cause of the reproduction of the disease. In the present instance, that facility had the additional inconvenience of giving rise to hemorrhage that might prove fatal.

Baron Dupuytren made compression above and below the wound; the former allowed blood to flow, the latter stopped it. The blood, therefore, he says, came from the lower and not the upper end of the artery. Graduated compresses and bandages were applied, five hemorrhages took place, and were suppressed between this and the thirty-sixth day, when the tumour, having apparently suppurated, was opened, and a quantity of sanious matter and thick pus was discharged. After this Berger went on well, and in two months was cured.

*Remarks.*—The collateral circulation restored the pulsation in the aneurismal sac on the sixth day. If there had been an open wound, Berger would have bled to death. If there had been a diffused aneurism with a hole or two in it, he would equally have bled to death. If the circulation had not been so restored as to enable the patient in such a case to bleed to death, he would have died of gangrene. Nothing can more clearly show the impropriety of placing a ligature on the external iliac artery for a wound of the femoral. This case was published in 1833, three years after the publication of my work, in which I have pronounced this operation to be inapplicable to a wounded artery, without a shut aneurismal-sac.

Case 103.—Sir C. Bell, in a lecture delivered at the Middlesex Hospital on the 20th December, 1834, made the following statement:—A man was wounded in the artery of the groin, and stopped the bleeding by holding the cut parts together until the surgeon arrived. He opened the wound, the man lost a quantity of blood, and fainted. The surgeon tied the artery, and went away. Hemorrhage recurred, and the man died. The surgeon was not aware, says Sir C. Bell, that the circulation is so free that the blood must flow by regurgitation where there is an open wound. A ligature must be applied first above and then below the wound in the artery.

Case 104.—William Besset, a man whose constitution had been much injured by mercury, was admitted into hospital on the 1st of December, 1816, with an extensive, irritable, and sloughing bubo in the groin. On the 26th of the month, the external pudic artery, which was involved in the ulceration, burst, and discharged about a pint of blood, which was restrained by pressure; a second hemorrhage took place next day, and the ulceration spread still farther. On the 31st, the blood sprung from the artery in a full jet, when the actual cautery and pressure restrained it. On the 12th of January, the hemorrhage again returned, and was controlled by pressure. It continued to recur so often from this period, that the life of the patient was in imminent danger, until, on the 22nd, a dreadful discharge of blood threatened at once to terminate his existence. Constant pressure was now applied, and next day, on consultation, the parts were accurately examined, when, on removing the clots, it was found that the femoral artery itself had given way. No other resource then remained but tying the external iliac, which was accordingly done. On the 24th the limb felt cold, and was insensible, except when firmly pressed upon. On the 25th the discoloration extended, a vesicle formed about the centre of the thigh, and a considerable quantity of coagula and sanies was removed from the groin. On the 1st of February, tension and pain of the abdomen came on, which was relieved by a dose of castor-oil. On the 2nd, vesication in various parts of the thigh began to establish itself. On the 9th, amputation was performed at a point close up to the trochanter, everything went on well afterwards, and the man perfectly recovered.—*Hennen's Military Surgery*, page 185, 2nd edition.

*Remarks.*—If the artery had been tied below or immediately under Poupart's ligament, so as not to have deprived the limb of the advantage of the collateral supply of blood from the epigastric and circumflexa ilii arteries, the man's limb might have been saved. The surgeon thought it safer for his operation not to interfere with diseased parts. Considering his operation *only*, he was right.

Case 105.—Dr. Warren of Boston, U.S.A., relates the following case in a recent communication to the Royal Medical and Chirurgical Society of London:—Amputation of the thigh was performed on account of disease in the condyles of the femur. Fifteen days after the operation hemorrhage occurred from a small artery near one of the angles of the stump, and at some distance from the ligature of the femoral, which still remained upon the artery. The parts were in a great measure united, so that it would have been extremely difficult to discover the bleeding vessel by dividing the recently united parts, and this was the only way it could be done. The patient being in a sinking state from the loss of blood, the femoral artery was tied four inches from the stump. The bleeding was arrested, but only for a week; it then returned from the same spot. The femoral artery was again tied at the distance of an inch below Poupart's ligament, care being taken to ascertain that the profunda was not immediately above the ligature. There was no return of the hemorrhage, and the patient became in a short time perfectly well.

*Remarks.*—According to my principles an incision should have been made on the anterior surface of the thigh through the parts down to the bleeding end of the artery, and a ligature should have been applied in sound parts, perhaps an inch above it, no branch intervening. The case is highly valuable, as showing how readily the profunda can maintain a hemorrhage, and how safely the femoral may be tied above its origin when sound. It may also be observed, that, although the last operation did succeed, it would have failed if the collateral vessels had been as entire as in Case 102 or 109.

Case 106.—A man, past the middle age, was sent to the Westminster Hospital by me in consequence of a large aneurism at the lower half of the thigh having been opened by mistake. The incision was too large to give hope of its healing, a large quantity of blood had been lost, and it appeared advisable as the case was so clear, to do something which might prevent a return of the hemorrhage. As this was an aneurism from disease of the artery, it was useless tying it at the wounded part. If the artery were secured at the usual place, it was probable that bleeding would occur from the open sac, and from the lower end of the artery, and seeking for that vessel in its passage into the ham, was likely to terminate badly. On consultation with Mr. White we decided on amputating the limb as giving the man the most certain chance of preserving life. It failed, however, of success, the man sinking after a few days from the defect of constitution, which had led us to prefer amputation as the least injury that could then befal him.

I had some regret after his death that I had not tied the femoral artery in the usual place, and stitched up the incision, covering it over with sticking plaster, compress, and bandage, so as to form a temporary barrier at least against bleeding, and thereby gain a little time, awaiting events. In the following case I practised it, but not with a more successful result:—

Case 107.—William Oakley, aged twenty-seven, admitted into the Westminster Hospital, September 10th, 1831, with an aneurismal swelling six inches in diameter, three above the level of the surrounding parts, the apex three inches below Poupart's ligament on the left thigh. The apex had been opened by mistake, and about four pints of blood had escaped. The complaint was at least of three months' standing. The external iliac artery was tied by me next morning, the 11th, and the man died on the 13th from gangrene of the extremity. Four ounces of fluid mixed with flocculi of lymph were found in the abdomen, the peritoneum being slightly inflamed for four inches around the incision, but being itself unhurt; the iliac artery was properly secured. The aneurismal sac contained eighteen ounces of coagulated grumous blood besides the layers adhering to the wall of the sac, which extended upwards under Poupart's ligament, in a line with the inside of the ilium.

*Remarks.*—The extension of the sac under Poupart's ligament rendered this operation difficult; and induced me in my subsequent ones to make the first incision more parallel to the ilium on the anterior part of the abdomen, which much facilitates the operation, enables the operator to tie the artery as high as he pleases, causes less disturbance to the peritoneum, and lessens thereby the chance of peritoneal inflammation. I was not at that time aware of the advantages to be derived from friction applied to the leg and foot in preventing gangrene, but tried everything else usually recommended, and failed, the man dying of mortification of the limb, and of peritonitis.

In the clinical remarks I made on this case, and which I did not know were published in the *Medical Gazette* for October, 1831, until I met with them lately, I drew attention to the fact that when an aneurism bursts, or when a spurious aneurism forms from a wound, the pulsation is not only seen, but the noise made by the blood against the edges of the cut or ruptured artery is peculiar, unless obscured by the great quantity of coagula formed after extravasation. It is worthy of remembrance.

Case 108.—A young man was some time afterwards admitted into the Westminster Hospital with a femoral aneurism extending so much under Poupart's ligament as to cause me to believe I should be obliged to place the ligature on the common iliac, and I performed the operation accordingly. I found, however, that I could conveniently apply the ligature (a single thread of strong dentists' silk) a little below its division into external and internal iliac arteries, at which spot it appeared to be sound on being brought into view by turning the peritoneum containing the intestines to the opposite side. Major Fancourt, then an M.P., was present, and he told me on leaving the hospital that the late Mr. Lynn thought the operation so dangerous, that when it was over he said to him, "There, Sir, you have now seen a man killed in a right surgical manner." It was in this case I first tried friction to the foot and leg kept up for hours. It was successful in preventing mortification, and the patient rapidly recovered. He died some eight years afterwards of disease unconnected with his aneurism, and Mr. Canton, of the Charing-cross Hospital, who assisted in the dissection, has favoured me with the account of the distribution of the collateral vessels.

"The ligature had been placed round the external iliac artery at a part almost immediately below where it passes from the common trunk. From this point to near Poupart's ligament the vessel was much contracted, and reduced to the condition of a dense, fibrous-looking, impervious cord, of about the size of a crow-quill, though more irregular in outline than it. The most contracted spot was where the artery had been tied.

"From where the deep circumflexa ilii and epigastric vessels are given off, the external iliac was found to be pervious, and of about its natural size. The above-named branches, together with the ilio-lumbar were somewhat larger, and more tortuous than usual. The gluteal and obturatrix arteries were of more than twice their natural size, and as much curved as the splenic. The ischiatic was enlarged, but not proportionally so much as the two former ones. All the *chief* anastomatic communications of these vessels, as the circumflex arteries from the deep femoral, &c., were increased in calibre, whilst the small subsidiary inosculating branches in the neighbourhood of the operation, as the superficial epigastric, circumflexa ilii, muscular twigs, &c., were of the ordinary magnitude.

"The most remarkable permanent enlargement in the vicinity was that of the little vessel pursuing a somewhat parallel course to the femoral trunk; the "comes nervi ischiatici" was about thrice as large as usual, and in its passage to the knee communicated with muscular branches, offsets from the perforating arteries, and in the ham, with some minor ramifications of the articular and muscular branches from the popliteal. The comes nervi ischiatici was so tortuous in its whole course that the convexities of the numerous curves almost touched one another."

Case 109.—Dr. Horner, of the University of Pennsylvania, placed a ligature on the external iliac artery, just above the origin of the epigastric artery, in consequence of an aneurism of the femoral in the groin, extending under Poupart's ligament, especially on its outer side. This operation having been completed with great precision, as was proved after death, Dr. Horner thought it right to open the aneurismal sac, which, after the laminated fibres and coagula had been removed, poured out arterial blood in the most formidable and urgent manner, so that the patient lost more than twenty ounces in a few minutes. The sac was further laid open, in doing which the femoral artery below was cut through, and both ends were immediately secured by ligature. This in part arrested the bleeding, but did not suppress it. It was then found that the upper end of the femoral artery coming into the superior part of the sac was pouring out blood; this was also tied. The bleeding then ceased, and as no bleeding orifice could be discovered on the inner surface of the sac, another ligature was placed on the femoral artery above the last by way of precaution. The man died exhausted, but without further bleeding, on the sixth day. Dissection showed inflammation and suppuration behind the peritoneum and the external iliac artery, up to and behind the right kidney. On examination of the aneurismal parts it was found that "an orifice of an inch in length existed on the iliac side of the femoral artery, that the sac itself was formed almost entirely by the contiguous cellular substance of the inguinal and iliac margins of the cavity of the sac. The profunda artery arose at or near the aneurismal orifice; the precise point," Dr. Horner says, "I did not ascertain, but I believe very close to its upper end; we may therefore conclude that the retrograde hemorrhage came from the anastomosing of its branches with those of the internal iliac artery, and also from the epigastric and circumflexa iliac judging from the incidents of the operation."

*Remarks.*—If Dr. Horner had been contented with his first operation he might perhaps have succeeded better. By opening the aneurismal sac he brought it into the state of a wounded artery, into which the collateral circulation readily brought blood, and he had to treat it as a wounded artery with the disadvantage of its being also a diseased one. It is an admirable case to prove the impropriety of treating a wounded artery communicating with an external opening by the operation for aneurism, done at a distance; for the bleeding must recur, as it has been shown to have done in almost every instance which has been adduced.

Case 110.—Col. F., aged thirty, of a powerful habit, was wounded by a small pistol ball, April 15, 1837, which entered the left thigh two inches below and a little within the anterior superior spinous process of the ilium, and ranging very nearly in line with Poupart's ligament, came out on the inner side of the thigh a little below the scrotum. It was followed by a profuse hemorrhage estimated at several pints; the patient fainted and remained insensible until next day; from this state he recovered, and in July a strongly pulsating tumour was felt just below Poupart's ligament in the course of the femoral vessels, which had the thrill and vibratory motion of varicose aneurism, with a loud, quick purring noise like that of a cat. A very strong pulsation was felt in the epigastric region; a feeble wavy pulsation was discernible in the opposite femoral vein at Poupart's ligament, as if arising from the arterial blood passing from the left femoral artery into the left femoral vein, and upwards to the vena cava, whence it was communicated downwards. Dr. Horner, satisfied that all varicose aneurisms should be operated upon at the part injured, tied the femoral artery on the 10th of the month, immediately below Poupart's ligament, and all pulsation ceased. On the 14th, mortification of the leg was evident, and eventually extended up to the tumour on the thigh. On the 26th the thigh was cut off through the mortified part. On the 2nd of August, twenty-two days after the operation, the ligature from the femoral artery was cut away. On the 3rd a small white and very sensible tumour, without pulsation, in the situation of the extremity of the artery was punctured; and a flow of blood took place, which pressure on the artery above did not suppress. This tumour, which proved on further investigation to be aneurismal, and of new growth, was cut off by various ligatures applied around it, when the bleeding ceased, showing that in all probability the hemorrhage had come from a retrograde instead of a downward current of blood, and which was proved to be the case after death. Twenty-eight days after the first operation, the parts included in the last ligature looked black and dead, and with the aneurismal tumour ready to drop off; the patient looked like a breathing corpse, but he did not die until four days after.

It was found on examination after death that the upper part of the femoral artery was firmly closed at its cut extremity for a line in thickness, having a conical coagulum of bloody fibrin adhering to it, about three lines in length, with the apex upwards. The lower part of the artery was separated from the upper at the part where the ligature had been applied; the canal of the artery put on the appearance of a dilatation; was thickened and pervious to its end. The femoral vein was open from below upwards, and exhibited signs of being inflamed as high as the ascending cava—a certain cause of death.

Dr. Horner supposes that mortification took place from the blood of the collateral circulation pushing its way into the femoral vein instead of descending to the foot, and he inquires whether the collateral branches should not if possible be enlarged before an operation for aneurism is performed.

Case 111.—Dr. Brainert, of the University of St. Louis, was called to a gentleman of Chicago, in Illinois, U. S., who had fractured the neck of the femur twelve weeks before, and which had not united. For twelve months after this he wore a starch immoveable bandage, when an aneurismal tumour was perceived at the upper part of the thigh under Poupart's ligament, and which he had seen for twelve weeks. The external iliac was tied, and the patient recovered, the tumor subsiding very slowly under pressure. The bone remained ununited. This was in all probability an aneurism formed from the broken bone having injured the artery some time before it took place.

Case 112.—Mr. Bransby Cooper in his Surgical Essays, page 79, relates the case of R. Weaver, who had suffered a compound, but not comminuted, fracture of the lower third of the femur, on the 5th of February, the opening in the integuments being a small laceration, over which a piece of lint was placed. On the 9th a diffused swelling in the ham was first perceived, evidently aneurismal. The femoral artery was tied in the usual place above the fracture, and the man recovered. Mr. Cooper observes, "With respect to securing the vessel, the surgeon would be guided in such a case by the situation of the external wound; for had the wound in this case been in such a situation as to admit the escape of the diffused blood, I consider the case would have been entirely altered, and that the limb must have been amputated, or else the wounded artery tied above and below the opening, which in the popliteal space could hardly be accomplished; but as the blood did not escape, the coagulum was capable of forming so firm a compression upon the wounded vessel, that upon the application of a ligature above there was no fear of the recurrence of the hemorrhage.

*Remarks.*—I concur in opinion with Mr. Cooper, and in the practice pursued, as the wound in the artery did not communicate with the external opening. If it had done so from the first, it would have been a question of amputation. In a healthy man I should have preferred, in the first instance, tying both ends of the wounded artery, and awaiting events, watching carefully the approach of mortification, for the purpose of removing the limb at the earliest possible moment.

# LECTURE VI.

*No operation should be done on a wounded artery unless it bleed at the time when the ligature is applied; Case of musket-shot wound at the upper part of the thigh; Repeated occurrence of secondary hemorrhage arrested by pressure on the main trunk; Cure without operation; Remarks on the case; Baron Larrey's case of sword-wound on the upper and anterior part of the thigh; Severe consecutive hemorrhage; Formation of a false aneurism; Cure by bleeding, and the local application of ice; Mr. Porter's case of wound of the profunda artery with a knife; Consecutive hemorrhage; Cure without operation; Mr. Cock's case of wound of the superficial femoral artery; Operation for exposing and tying the wounded vessel, the great depth preventing the application of the ligature; Success of pressure by a piece of sponge passed down to the bottom of the wound, and the application of a ligature on the femoral artery about the middle of the thigh; Case of wound of the upper part of the thigh by a duck-shot; Repeated hemorrhage; Formation of a diffused aneurism, opened in error; recurrence of hemorrhage; ligature of the femoral artery high up; Repeated hemorrhages terminating fatally; Remarks on the case; Case of wound in the upper part of the thigh; Occurrence of severe hemorrhage; Formation of a false aneurism; Ligature of the external iliac artery; Death from peritonitis; Post-mortem appearances; Case of wound of the arm-pit; Repeated secondary hemorrhages; pressure on the subclavian ineffectual; The bleeding arrested by enlarging the wound, and the application of pressure directly on the bleeding aperture in the artery; Ligature of the subclavian above the clavicle; Return of the hemorrhage from the arm-pit, and subsequent hemorrhage from the wound of the operation; Ligature of the innominata; Death of the patient in ten hours; Post-mortem appearances; the axillary artery uninjured, the inferior thoracic completely cut across; Comments of the editor of the Lancet on this case; this case a parallel one with that immediately preceding, and the editorial remarks equally applicable to both; Comments on these cases, with the requisite surgical treatment, and the operations which were performed objected to, and condemned.*

There is no point more important than that to which I must now *especially* call your attention. It is that no operation should be done on a wounded artery unless it bleeds, inasmuch as hemorrhage once arrested may not be renewed, in which case any operation must be unnecessary. The first case to which I shall refer shows how firmly the principles on which wounded arteries ought to be treated, were fixed in my mind in the year 1812; and if there is one case to which I look back with more satisfaction than another, during that eventful period, it is the following.

CASE 113.—John Wilson, of the 23rd regiment, was wounded at the battle of Salamanca by a musket ball, which entered immediately behind the trochanter major, passed downwards, forwards, and inwards, and came out on the inside of the anterior part of the thigh. The ball could not have injured the femoral artery, although it might readily have divided some branch of the profunda. Several days after the receipt of the injury, I saw this man sitting at night on his bed, which was on the floor, with his leg bent and out of it, another holding a candle, and a third catching the blood which flowed from the wound, and which had half filled a large pewter basin. They seemed to think it would stop in due time, having bled once before during the afternoon. I placed a tourniquet with a thick pad as high as possible on the upper part of the thigh, and requested the officer on duty to loosen it in the course of an hour, which was done, and the bleeding did not recommence. The next day I placed the patient on the operation table, removed the coagula from both openings, and tried to bring on the bleeding by pressure and by moving the limb; it would not however bleed. As there could be no other guide to the wounded artery, which was evidently a deep-seated one, I did not like to cut down into the thigh without it, and the man was replaced in bed, and a loose precautionary tourniquet applied. At night the wound bled smartly again, and the blood was evidently arterial. It was soon arrested by pressure. The next day I placed him on the operating table again, but the artery would not bleed. This occurred a third time, and with the same result. The bleedings were however now almost immediately suppressed, whenever they took place, by the orderly who attended upon him; care having been taken to have a long thick pad always lying over the femoral artery, from and below Poupart's ligament, upon which he made pressure with his hand for a short time. The hemorrhage at last ceased without further interference, and the man recovered.

This case was to me of considerable interest, more particularly because I had not decided in my own mind what operation should be done. I did not like to place a ligature on the femoral artery above the profunda, neither was I satisfied with the idea of tying the profunda an inch below its origin. It was on this account that I was desirous that the wound should bleed at the moment of operating, as my finger introduced into it might lead to the spot whence the blood flowed, whilst I might also be guided in forming my opinion, by the manner in, and place at which pressure caused it to cease. I might have tied the profunda, but I certainly would not have tied the superficial femoral artery. My intention was however to ascertain if possible whether the wounded artery would be more easily got at by a transverse incision on the fore or back part of the thigh, and to proceed accordingly. In a similar case I should introduce my finger into the wound, and enlarge it transversely, continuing the incision until the opening was sufficiently large to see to the bottom of the wound or the bleeding part. It is necessary to be attentive to the course of the great vessels and nerves, but not to the safety of muscular fibres, the division of which leads to no permanent injury. I am aware, that as pressure on the main trunk led to the ultimate suppression of the hemorrhage, it may be said, that a ligature placed high up on the femoral artery would not only have done the same, but would have relieved the man from the anxiety necessarily dependent on the momentary fear of a recurrence of the hemorrhage. There are two objections to this method of proceeding: the likelihood of mortification taking place, which I have sufficiently shown to be in similar cases a probable occurrence; and the possibility of the hemorrhage being renewed through the anastomosing branches. The temporary suspension of the circulation by pressure does little or no harm, more particularly where the pad used is so thick as to cause it to fall principally on the artery, and only in a slight degree on the surrounding parts, which by a little attention may be readily accomplished. I have succeeded in many instances of hemorrhage from less important places, by proceeding in this manner; but I have selected this particular case as an example to ground the proper line of practice upon, because it was of more importance than most of those which usually fall under the observation of the surgeon. It is not good practice to cut down upon an artery on the first occurrence of hemorrhage, unless it be so severe or so well marked as to leave no doubt of its being from the main trunk of the vessel itself; nor is it then advisable to do so except the artery continue to bleed; for many a hemorrhage, supposed to have taken place from the main trunk of an artery, has been permanently stopped by a moderately continued pressure exercised in the course of the vessel, and sometimes on the bleeding part itself, particularly if the blood be of a dark colour, indicating that it comes from the lower end of the vessel.

*Remarks.*—This case was printed with the preceding annotations on it, in 1830, in my work on the Diseases and Injuries of Arteries. It shows that the practice I now inculcate is not that of this day, and I am particularly desirous that this fact should not be overlooked. It is my apology and my authority for condemning an opposite practice in my cotemporaries.

A painter could not have had a better subject for a picture illustrative of the miseries which follow a great battle, than some of the hospitals at Salamanca at one time presented. Conceive this poor man, late at night, in the midst of others, some more seriously injured than himself, calmly watching his blood—his life flowing away without hope of relief, one man holding a lighted candle in his hand, to look at it, and another a pewter wash-hand basin to prevent its running over the floor, until life should be extinct. The unfortunate wretch next him with a broken thigh; the ends lying nearly at right angles, for want of a proper splint to keep them straight, is praying for amputation or for death. The miserable being on the other side has lost his thigh; it has been amputated. The stump is shaking with spasms; it has shifted off the wisp of straw which supported it. He is holding it with both hands in an agony of despair. You may think I am exaggerating; I assure you I am not, and I refrain at the present moment from saying much more, which however I shall tell you at some future day, that I may not attract your attention from our all-important subject.

Case 113.—D. Hyppolite was wounded on the 9th of April by the point of a sword on the superior, external, and a little on the anterior part of the right thigh, about three inches and a-half below the anterior inferior spine of the ilium, which penetrated to the depth of two inches and a-half in a horizontal direction from without inwards, and a little backwards, so as to injure, as was supposed, the external and back part of the femoral artery. The wound bled profusely by jets, until the man fainted, when it ceased, but was renewed next morning, and was arrested with the greatest difficulty. On the 11th, when admitted into the hospital of Gros Caillou under Baron Larrey, there was a pulsating swelling in the right groin of a slightly blue colour, the size of a man's fist, extending from the anterior inferior spine of the ilium to the pubes. He complained of a feeling of cold in the leg and foot of the affected side, and of great heat in the swelling. The pulse was hard, full, and vibrating. He was bled twice in the first twenty-four hours, had iced barley-water to drink, and an antispasmodic nitrated emulsion at night. The leg was bent on the thigh, and the thigh on the pelvis, the patient being laid on his back in bed. A cold emollient poultice was laid on the swelling, and the leg was wrapped up in hot flannel. These symptoms subsided by degrees, and after the third day pounded ice was added to the cataplasm. Under these means the inflammatory symptoms gradually yielded, the swelling diminished in size, and the pulsations became less strong. Ice contained in a bladder was substituted for the iced poultice, and was frequently renewed, and continued without interruption. The circulation through the artery below, which had been at first arrested, was gradually restored by the collateral circulation, and the man recovered.

*Remarks.*—This case should be always in the recollection of surgeons, offering an example to be followed in all similar instances. Case 62, also by Baron Larrey, and Case 63, by Delpech, are instances so honourable to these gentlemen on the same point, that I cannot refrain from gratifying my own feelings by offering this homage, as it is expressed in France, to their memories.

Case 114, by Mr. Porter of Dublin.—A boy attempting some improper liberties with a female servant was struck by her with a knife on the superior part of the thigh, and the profunda artery was wounded. The bleeding was immediately controlled, but after nine days burst out again, welling forth without impetus, and coming from the inferior section of the artery. Pressure was applied, but ineffectually, for in a little time he bled again, and after several recurrences, it was proposed to tie the external iliac artery. On being placed on the table for that purpose, some one remarked that he had not bled since the previous evening. He was therefore replaced in bed, and never bled afterwards.

*Remarks.*—If the external iliac artery had been tied, the cure would have been attributed to it, and if mortification or peritonitis had supervened, it would have been said that they were unavoidable evils, and instead of applauding Mr. Porter's just decision, the invaluable example he set, and the sound knowledge of the proper treatment of wounded arteries he exhibited, I must have passed his case by without a favourable remark. If, unfortunately for the lad, the external iliac had been tied, and the bleding had recurred, Mr. Porter must, I presume, have tied the common iliac, and if that had not succeeded, the aorta, or he must have descended to the more simple operation of cutting down upon and tying the bleeding vessel, and thereby saving the patient's life, if not too late.

Case 115, by Mr. Cock of Guy's Hospital.—H. P., aged twenty-six, a butcher, healthy, and of temperate habits, was admitted into Guy's Hospital under the care of Mr. Cock, on the 19th of October, 1844 (see 26th vol. of *Medical Gazette*). In dividing a calf's head his knife slipped, and entered his thigh on the inner side, near the junction of the middle and lower third, and penetrated to the extent of some inches. He lost a large quantity of blood, and became faint. Pressure, and the prompt application of a tourniquet, effectually prevented further hemorrhage. An hour after the accident, he was in a state of complete collapse, but sensible and collected. Below the tourniquet the thigh was distended with effused blood, and he complained of great pain and numbness of the whole extremity. On relaxing the tourniquet arterial blood flowed freely from the wound, which was about an inch in length, and extended transversely across the situation of the sartorius muscle, exposing the fascia beneath. The tourniquet placed over the femoral artery below the origin of the profunda, completely commanded the bleeding. The superficial femoral had sustained the injury, and it was determined to follow the track of the wound, if possible to the artery, and place a ligature above and below the opening in the vessel where injured. The tourniquet having been removed, and the artery commanded by pressure at the groin, a longitudinal incision was made in the direction of the femoral artery. The sartorius was found to be divided across, and retracted upwards to a considerable extent, the extremity presenting a large, rounded, bulbous appearance. On cutting through the fascia a large quantity of extravasated blood was brought into view, and no sooner was this disturbed and partially removed than a copious gush of dark coloured blood took place, and continued to flow freely, as was supposed, from a large vein. Mr. Cock then discovered that the wound had a direction downwards, to the extent of at least four inches into the popliteal space, and it appeared most probable that the vessels, both artery and vein were cut, as they emerged from the lower opening of the canal of the adductor magnus. The great depth of the wound, and the free venous hemorrhage, precluded the possibility of tying the artery at the seat of injury. The bleeding was first stopped by introducing a piece of sponge down to the bottom of the wound, and by exposing and placing a ligature on the femoral artery about the middle of the thigh. The bleeding, both arterial and venous, was then effectually arrested; the edges of the wound was brought together by suture and plaster, except at the lower part, where the sponge had been introduced. The limb was placed in an easy position, the leg and foot covered with flannel, and he took thirty drops of tinct. opii, brandy and water, &c., and passed a tolerable night. On the fourth day after the accident suppuration of a healthy character commenced ; the sponge was subsequently removed, the edges of the wound were approximated, and supported by plaster, and he was ordered quinine with morphia at night, with a generous diet. The suppuration was extensive. The ligature came away on the fourteenth day; the cure was not however completed until the end of March.

*Remarks.*—There could be no doubt of the propriety of placing a ligature on the femoral artery immediately above where it was injured. If the femoral artery when exposed had been followed downwards, it is possible the dissection would have shown the wound in the artery, and that the venous blood flowed from the lower opening in it. The sponge thrust into the lower part of the wound acted as a compress, and as the collateral circulation is not established with much impulse in the first instance, the operation succeeded, and in a manner highly creditable to Mr. Cock. If the sponge had not been sufficient to prevent a recurrence of the hemorrhage, Mr. Cock would have been obliged to follow the artery, if necessary, into the popliteal space. This might have been done by extending the incision in its length, or by making the finger protrude below over the artery, and then cutting down upon it. A Pouteau's or curved trocar and canula may be used in such cases with advantage as a director.

CASE 116.—A young gentleman, aged twelve, accompanying his brothers shooting in December, 1844, was struck in the upper part of the left thigh by a duck-shot, which entered about three inches below Poupart's ligament, and a little to the inner side of the femoral artery. He bled until he fainted, and was taken home. There was no return of the bleeding for three days, during which time the limb was exceedingly painful, and soon began to enlarge. After this time occasional and considerable bleedings took place, the limb still continuing to enlarge. Fomentations and poultices were applied; irritative fever set in, and the pain was intense. At the end of a fortnight the small hole made by the shot appeared to be healed over by a thin skin of a blue colour, which tint extended for some distance. The limb was enormously swollen, with a feeling of distension, which induced the surgeon to puncture the most prominent part with a lancet. After some clots of blood had been removed, an alarming arterial hemorrhage took place. The femoral artery was now tied high up, below Poupart's ligament. The bleeding was in some measure restrained, but not suppressed, and after a short time returned at intervals with augmented violence, until death ensued, three weeks after the accident.

*Remarks.*—If an incision had been made into the thigh in the course of the wound when the bleeding returned on the third day, and both ends of the wounded artery had been tied, the boy would doubtlessly have recovered. The ligature placed on the femoral artery above the wound in it did restrain for a short time the flow of blood, but could not prevent its flowing from perhaps both ends of the vessel, until it destroyed the patient. A ligature on the external iliac would only have caused it to be deferred for a day or two, until the collateral branches had enlarged, or else he would have died of mortification. The case was a bad one from the moment the thigh began to be so greatly injected with blood, but the decision shown by Mr. Keate in Case 13, and by Mr. Norman in Case 96, might have saved his life, even almost unto the last. In this case it was exceedingly possible that the profunda was injured, and not the femoral artery, the tying of which or of the external iliac could not have done good for a permanency, as the bleeding would doubtlessly have returned on the establishment of the collateral circulation.

This really formidable case shows most distinctly the necessity for always observing the rule of tying the wounded artery at the part injured, in order that the mistake may not be made of placing a ligature on the wrong artery—the constriction of which may cost the patient his life, whilst it may not prevent a return of the bleeding. It also shows that no loss of blood from a diffused aneurism can equal the danger which must be encountered, and the mistakes which may be made, by not laying it open, and seeing the hole in the artery, or its divided extremities. These cases may be considered together with the greatest advantage, as indicating the principle of surgery to be pursued in all similar instances.

CASE 117.—A short man, fat of his age, was wounded in the upper part of the right thigh, a little above and in front of the great trochanter, the wound being continued across the thigh, its internal opening being about the middle of the fold of the left or opposite groin. He lost a good deal of blood at the time, the issue of which ceased on his fainting. Ten days after the accident his countenance was blanched, his pulse rather quick and feeble. On examining the wounds, that on the right hip (the opening of entrance) was circular, filled with a dry, depressed slough, and there was a narrow, faint blush of redness round its margin. In the left groin the opening of exit was marked by a jagged slit, already partly closed by a thin cicatrix. There was extensive mottled purple discoloration (ecchymosis) of the skin in both groins, and over the pubes, scrotum, and upper part of the right thigh. In the right groin was found a large, oval, visibly pulsating tumor, its long diameter extending transversely from about an inch and a-half on the inner side of the anterior superior spinous process of the ilium to about opposite the linea alba, and its lower margin projecting slightly over Poupart's ligament into the upper and inner part of the thigh. On handling this tumor, it appeared elastic, but firm, very slightly tender, and not capable of any perceptible diminution in bulk by gradual and continued pressure. The pulsation was distinct at all parts of the swelling, and was equally evident whether the fingers were pressed directly backwards, or whether they were placed at its upper and lower margins, and pressed towards the base of the tumor, in a direction transversely to its long axis, the parts being for the time relaxed. The femoral artery was slightly covered by a swelling, and the pulsations of that vessel were with some difficulty distinguished in the upper third of the thigh, below the margin of the tumor. This appeared to depend partly on the natural obesity of the patient, and partly on a considerable degree of general swelling of this thigh. Pressure on the femoral artery or over the abdominal aorta did not arrest the pulsation in the tumor, and in the former situation was attended with severe pain. Under these circumstances it was deemed advisable to apply a ligature on the external iliac artery, and give the patient a chance of the occurrence of coagulation in the tumor, and closure of the wounded vessel, before the free re-establishment of the circulation through the femoral artery. In the present case, it was supposed that mortification of the limb was all the less likely to occur from the circumstance that the greater part of the effusion appeared in front of the abdominal parietes, and therefore exercised less pressure on the femoral vein than if further extension into the thigh had taken place. The danger of peritonitis was by this proposal made a new element in the calculation; but it was estimated that the chances of this and mortification of the limb taken together were less unfavorable than the chances of immediate and secondary hemorrhage attaching to the operation of tying the artery at the spot injured. The operation being completed, the right foot, leg, and thigh were enveloped in lamb's-wool and flannel, and the limb elevated on an inclined plane of pillows, so as to favour the return of blood as much as possible, and prevent venous congestion. The day on which the operation was performed was passed in considerable pain, the patient being restless, and complaining of a sense of burning in the limb. An anodyne, however, secured him a tolerably good night's rest. The day after the limb was found altogether diminished in bulk, and its temperature equal to that of the healthy limb; no return of pulsation had taken place in the tumor. The same evening some tenderness and tension of the abdomen came on, though the bowels had been kept in a regular state by occasional small doses of castor-oil. In the morning of the second day, pain in the belly, with increased tension, hurried breathing, short dry cough, and tenderness over the lower part of the abdomen, were observed. Pulse quicker and small. Leeches were applied, and three grain doses of calomel, with a little Dover's powder, ordered every three hours. The symptoms however became rapidly worse; the patient complained of severe pain in the right leg, and a sensation of great heat over the whole body, although the actual temperature was rapidly falling below the natural standard. The right leg also became cold sooner than the left. At seven, p. m., he became more easy, and expressed an opinion that he should "do well;" but in little more than half an hour he expired.

*Examination after Death.*—Swelling and ecchymosis of the right thigh, particularly at the upper part, and in the right iliac region; also swelling and ecchymosis of the scrotum, chiefly in the right side, with general tumefaction of the abdominal parietes below the umbilicus. A wound into which the little finger could be passed was on the upper and outer aspect of the right thigh, about three inches below the crest of the ilium, and about an inch nearer the mesial line than the great trochanter, and on the left side another smaller wound situated about the external aperture of the left spermatic canal. The first-mentioned wound was open—the lips of the latter were partially adherent. The course of the wound was traced from the outside through a dense layer of fat about two inches in thickness (on an average). It had divided one of the superficial branches of the femoral artery, about half an inch below Poupart's ligament, and about an inch from the main body of the femoral artery, which had caused a false aneurism. The sac contained about three ounces of blood. Blood was also effused into the cellular structure of the scrotum, and downwards beneath the sartorius muscle. The wound passed through the cellular tissue, across the pubes, and emerged about the situation of the external spermatic ring, without having divided the cord on either side, and being quite superficial to the bladder. No other artery appeared to have been wounded. When the parietes of the abdomen were reflected, a considerable quantity of sero-purulent fluid was found in the abdominal cavity; and on different parts of the large and small intestines, patches of acute inflammation were observed, particularly on the ascending arch of the colon. The peritoneum adjoining the wound of the operation was inflamed, and approaching to gangrene; it had not been injured by the knife during the operation. The intestines were unusually large, and distended with flatus. The other abdominal viscera were healthy, but loaded to an extraordinary degree with fat. The ligature had been properly applied to the iliac artery; the vein was not injured; the surface of the wound and the cellular tissue in the neighbourhood of the artery were sloughy. There was some enlargement of the right limb, but apparently no mortification. The femoral artery was pervious; the course of the wound was through a bed of fat, fourteen inches in length, and three inches in depth, over the pubes, and no muscular substance was injured; the blood found in the aneurismal sac was firmly coagulated, and there was no mark of recent oozing from the injured artery.

Case 118.—N. Cormier, a soldier, with the army at Oran, in Algeria, received a wound in the hollow of the arm-pit from the point of a scissors mounted on the end of a stick, the flow of blood from which was arrested by some handkerchiefs bound tightly upon it. Four days afterwards a small bleeding took place, which was followed by three others during the subsequent eight days, all of which stopped spontaneously on removing the dressing. On the twelfth day he complained of great pain, which was attributed to the dressing not having been changed for four days; on removing them a jet of arterial blood followed, as large as a quill. Pressure was made on the subclavian artery, but it did not seem to be effectual, for as the blood was prevented from escaping by the external wound, the arm-pit became visibly more and more distended; the wound was therefore enlarged, when an assistant placed his finger on the bleeding hole in the artery and arrested the bleeding. The French surgeon then tied the subclavian artery above the clavicle, and prevented an immediate return of the hemorrhage.

On the sixth day after this operation the patient rose from his bed and walked across a yard, which gave rise to *bleeding from the arm-pit*. This was arrested by cold applications. During the night and the following day he lost more blood. Three days afterwards, or the ninth from the operation, the ligature on the subclavian artery was found loose in the wound, and the dressing was saturated with blood, the discharge being fetid. This wound bled three times during the evening, and at twelve at night the surgeon placed a ligature on the arteria innominata (*le tronc brachio-cephalique*).

The patient died ten hours after the completion of this operation. On examination after death the ligatures were found to have been properly applied, but, contrary to what was supposed, the axillary artery was uninjured; the blood came from one of its branches, the inferior thoracic, which was completely cut across about a centimetre or thirty-nine hundredths of an inch, or *five* lines from its origin from the axillary artery.—*From the Archives Générales, p.* 101, 1842, *Annales de Chirurgie,* page 19.

The editor of the Lancet comments as follows on this case in the volume for 1841-42, page 230:—

"Our object in noticing the case is, not only to furnish our readers with one of the most striking instances of the folly of applying to wounded arteries the same operation as for aneurism, but also to make a few practical remarks, which we believe will be found in none of our surgical works. Where a large artery, whether it be the principal artery of a limb, or one of its branches, is wounded, it is an established rule to tie the artery above and below the wound; two ligatures are therefore required, but in some cases, the above for example, instead of two, three ligatures would be requisite. A butcher (says M. Laugier, in his *Bullétin Chirurgicale*) cut his wrist deeply; hemorrhage ensued; compression of the brachial artery arrested it; but circumscribed pressure on the radial above and below the wound had no effect. The wound was enlarged, and the blood was perceived escaping from an opening in the ulnar side of the radial. Two ligatures were applied, one above, the other below the opening; the hemorrhage however continued. It was thought for a moment that the interosseus might have been wounded, the knife having passed deeply from without inwards, but on examining carefully, the superficialis volæ was seen bleeding; it had been divided immediately at its origin, on a level with the radial. A ligature was passed around it, and the hemorrhage ceased. Let us now examine what would have occurred in case No. 118 if, as he should have done, the surgeon had enlarged the wound, and attempted to tie both ends of the bleeding artery. The inferior thoracic had been divided close to its origin from the axillary, leaving scarcely sufficient length for the ligature of its upper orifice; it would therefore have been requisite to have placed a ligature round the axillary, above and below the origin of the thoracic, and, in addition, a third ligature round the inferior orifice of the divided thoracic, from the numerous anastomoses between it, the internal mammary, and superior intercostal arteries. It may be objected that the third ligature could be advantageously replaced by compression. This might be true in M. Laugier's case, where pressure on the superficialis volæ, as it passes over the carpus, could be easily effected; but it would have been wholly inapplicable to case No. 118 from the depth of the axilla, and from the impossibility of applying compression methodically. We have thrown out these few remarks, as similar cases may occur, and prove extremely troublesome and puzzling."

I have placed these two cases in juxta-position, because no two can be found more exactly resembling each other, as far as regards the defective nature of the principles on which they were treated. Both were supposed to be cases in which the main trunk of a large artery was wounded. In both the main trunk was tied at a distance from the part wounded; and in both the patients died of evils foreign to the original injury. On examination after death it was found that a great mistake had been made in both—that in neither had the main trunk been injured. The criticism of the editor of the Lancet on the French case, No. 118, is honest, true, and just, although too severe. It is as applicable to 117 as to 118, to one operation as to the other, and must be applied to both, unless there is one manner of criticising French surgery, and another for English surgery. The French surgeons committed, in my opinion, an error in principle only. The impromptu manner in which they first tied the subclavian artery, and afterwards the arteria innominata, is above all praise. They showed an admirable knowledge of anatomy combined with great surgical dexterity. The English surgeons showed equal anatomical and surgical skill and ability, and are no less deserving of the highest commendation. They both, however, deviated from those principles which are so well laid down by the editor of the Lancet—principles which I have advocated for so many years, and which I am now endeavouring to enforce—they all failed in consequence, and lost their patients through errors in principle, but not in practical surgery.

This they deny, and on the contrary affirm, that the principles and the practice pursued in these cases are not only the correct principles and practice, but that they ought to be followed in similar instances. Some other surgeons of character and estimation have supported their views, and others, of even perhaps greater reputation in England, Ireland, France, and America, have lately concurred in the expression of the same sentiments. The gentlemen concerned in cases 117 and 118, are not only acquitted by them of any error, but they are authorised, as far as their approval goes, to do the same thing again; and there can be little doubt if other cases of the kind were to occur, that there are surgeons to be found who would adopt a similar practice, to be followed in all probability by the same fatal results. It is not, then, a persona question founded on envy, malice, and all uncharitableness, which is to be discussed, as it has been hastily said to be; but a great principle in surgery, implicating life to the utmost extent. It is a principle on which there cannot be a compromise—the Hunterian theorists are right or wrong. They must overcome the observations, the practice and the principles formed and established during the late war in Portugal, Spain, France, and the Netherlands; or they must yield even if they will not acknowledge their errors. That they are discomfited is proved by almost every case I have adduced, and if anything were wanting to render their defeat more complete it is to be found in cases 117 and 118. They are like beacons on each side of the Channel, standing out in all the refulgence of their light, to warn future surgeons of their respective countries from the paths of error and of death.

The French surgeons were compelled to do something or let their patient bleed to death. They proceeded therefore to do the right operation of arresting the flow of blood through the artery, by placing a ligature upon it. They applied it however according to the Hunterian theory, on the wrong artery and in the wrong place, and lost their patient, which they would not have done in all probability if they had tied up the hole in the artery which really was wounded, instead of the trunk of one that was uninjured; but from which it sprung at the distance of five-twelfths of an inch, a distance sufficient to have enabled the surgeon to have applied a ligature with safety and success. The English surgeons tied the main trunk at a distance instead of the wounded branch, committing the additional error of disregarding that essential principle of surgery, which declares that an operation is not to be done on a wounded artery unless it bleeds. The examination after death proves that the small artery which had been injured had ceased to bleed, that it was not likely to bleed again, that the quantity of blood effused did not exceed three ounces, and that even this was firmly coagulated. If the bleeding had been renewed, and the blood had escaped through the opening in the outer part of the thigh in such quantity as to render some operative assistance advisable, or if the blood could not find issue at the moment through the opening, in consequence of some part of the track of the injury having closed, and the tumor had increased, and *was manifestly increasing* to a size so considerable as to be capable of containing from eight to twelve or sixteen ounces of blood, an incision should in either case have been made through the wall of the tumor, and the wounded vessel exposed and secured, whatever it might have been; by which proceeding all possibility of mistaking the wounded artery must and would have been avoided.

According to the principles I maintain to be correct, no operation whatever should have been done in this case, and none would have been required; or if one should have become necessary from any accidental or incidental cause, it need have been nothing more than a simple incision for the evacuation of the contents of the swelling and for the ligature of the small vessel injured. According to the principles maintained by my opponents, they could do neither more nor less than they did: they lost their patient in consequence, and they will generally do so when they act on similar principles on similar occasions. It is for the profession to decide whether principles so deadly in their application shall be any longer permitted.

Three supporting and exculpatory hypotheses have been brought forward and for the first time in aid of the Hunterian theory, all of which I have shown and proved to be worthless:—1st. The supposed insecurity of a ligature placed on the upper part of the femoral artery when in a sound state, has no foundation, as several of the cases I have adduced distinctly show. 2nd. The fear of tying a branch of an artery an inch from its origin lest it should give way from this cause, is thoroughly disproved by the experience of every man who has amputated arms at or near the shoulder-joint. In my book on the Diseases and Injuries of Arteries I have said, page 376, "I have seen the epigastric artery divided in the operation of placing a ligature on the external iliac artery and two ligatures placed upon it without any inconvenience occurring; and I have reason to know that this artery is made a greater bugbear than there is any occasion for in all operations on these parts. If the surgeon has unluckily divided it, either in this or in any other operation, all that he has to do is to enlarge the incision, and tie both the divided ends; and I have no hesitation in saying it will not be of any consequence, either in this operation or in one for hernia." I was not aware when I wrote that passage, some sixteen years ago, that there would be a day when theory would attempt to refute what ample experience had fully established. As to the 3rd, or the fear that the loss of blood consequent upon the opening of an aneurismal swelling may destroy the patient, I can only say, that as far as my knowledge extends no such thing has ever occurred, and as it never could have occurred in the hands of any of the very able French or English surgeons who were concerned in the two cases alluded to, I shall not take the trouble to refute the possibility of an occurrence which I am satisfied never could have taken place.

The great principles of surgery to be observed in cases of wounded arteries, especially such as the axillary and the femoral, and which ought never to be absent from the mind of the surgeon, are two in number:—

1. That no operation ought to be performed on a wounded artery unless it bleeds.

2. That no operation is to be done for a wounded artery in the first instance but at the spot injured, unless such operation appears to be impracticable.

When Mr. Hunter impugned the principle on which his predecessors and his cotemporaries acted in cases of diseased arteries admitting of surgical operation, he neither doubted their skill, their ability, nor their anatomical knowledge; he merely said to them, the principle on which you proceed is bad; it causes you to do your operation in the wrong place. Change your principle, do your operations with the same knowledge and the same dexterity as at present, but do them in a different place. The difference which existed between Mr. Hunter and his cotemporaries is exactly the difference which exists at the present moment between me on one side, and my opposing cotemporaries who think and act differently on the other. It has nothing to do whatever with the professional character, ability, or dexterity of any of them: it is simply a question of principle, and which party is right or which is wrong the profession must, I again repeat, decide. In the law, Chancellor No. 2 overturns the decisions of Chancellor No. 1; he in his turn is overruled by Chancellor No. 3, who, by another reverse of the wheel of fortune, finds himself in the condition of having his decrees overthrown in succession by perhaps both Nos. 1 and 2. These chancellors however always remain good friends, and the public have not a worse opinion of them than they had before they disagreed, not with each other, but with the law of the respective cases submitted for their decision. It ought not to be otherwise in surgery than in law. It is in man to err.

# LECTURE VII.

*Wounds and injuries of the throat and mouth implicating the carotid artery; Case of fatal ulceration of the carotids caused by a foreign body in the œsophagus; Staff-Surgeon Collier's case of wound at the angle of the jaw, penetrating into the mouth; Severe consecutive hemorrhage; Successful ligature of the common carotid; Mr. Mayo's case of hemorrhage from ulceration of the pharynx; Successful ligature of the right common carotid; Mr. Luke's case of hemorrhage from ulceration of the throat; Successful ligature of the left carotid; Case of cut throat; Wound of the internal jugular vein, and of the external and middle coats of the carotid; Consecutive hemorrhage; Ligature of the common and external carotids, followed by death from weakness; Staff-surgeon Maling's case of ligature of the common carotid for a wound of the throat; The external carotid should generally be tied in all cases of hemorrhage from the throat which cannot be otherwise arrested; The ligature of the common carotid should be a last resource; The consequences of ligature of the common carotid; Mr. Vincent's cases of paralysis following that operation; Sedillot's case of hemiplegia after ligature of the common carotid; Dr. Twitchell's case of sloughing of the internal carotid from a burn with gunpowder; Ligature of the injured vessel unsuccessful in arresting the hemorrhage; Success of compression; Dr. Warren's case of ligature of both carotids for erectile tumour of the lower lip and tongue; Treatment of wounds of the hand and foot, accompanied by hemorrhage; Wounds of the radial artery where it dips into the hand; Wounds of the ulnar artery; Case of wound of the ulnar artery near its origin; Ligature of the brachial; Failure of the operation in arresting the hemorrhage; Ligature of the ulnar artery; Remarks on the case; Wounds of arteries in bleeding; Case of wound of the brachial artery during venesection; Attempts to arrest the hemorrhage by compression; Ligature of the artery; Amputation and death; Circumscribed or diffused aneurism, aneurismal varix, or varicose aneurism, the result of wound of the artery in bleeding.*

It is not possible in every instance to reach the wounded part of an artery without making greater sacrifices and without incurring greater dangers than are consistent with that prudence and discrimination which should distinguish an accomplished surgeon. Wounds and injuries of the throat and mouth, implicating the carotid artery, furnish the most prominent examples of difficulties of this nature, and the propriety of placing a ligature on the main trunk at a distance from the part wounded under these particular circumstances, must now be considered

Case 119.—A soldier, in the year 1805, complained to me of sore throat, difficulty of breathing, and uneasiness in his chest, which he said arose from certain blows received from the drill serjeant in consequence of his awkwardness. No proof could however be brought of the blows or of any ill-treatment, further than that he had been drilled for several hours daily to make him keep his shoulders back, but in vain. The fauces were slightly reddened. After a few days the throat became more inflamed, although not to any great extent, and he was utterly incapable of swallowing anything but liquids. This was followed by a ptyalism, as if under the influence of mercury, which induced me to tax the man with having made himself ill, but he would not acknowledge it, although I promised him a pardon on telling the truth. He soon began to spit blood, of a light scarlet colour, but without any cough; and this increased in quantity daily, until at last the orderly informed me there was a coagulum in the bottom of his spitting pot every morning, equal to six or eight ounces of blood. A day or two afterwards the blood began to pour out of his mouth so rapidly, that he sent for me. I arrived however only in time to see the blood fill the chamber-pot, when he fell back dead. On opening the body, I found an instrument lying across the commencement of the œsophagus, composed of two half phial corks, fastened together by strong thread, having previously had three pins thrust through each of them, so that the heads of the pins were applied to each other, back to back, the points sticking out beyond the cork, forming a sort of chevaux-de-frise: this, it is presumed, he covered with fat, and attempted to swallow; but the point of a pin catching, the efforts to swallow turned the machine across. In this situation the points of the pins were close to the carotid arteries, and having by degrees given rise to ulceration of the œsophagus, wounded them on both sides; every elongation or pulsation of the arteries having brought them against the point of one or more of the pins, the marks of which were observable in several small holes of different sizes on the sides of the vessels. As one or two of these became larger, from the constant attrition, blood came through into the œsophagus; and as they again increased by ulceration, larger holes were formed, from which the sudden and fatal hemorrhage took place. The instrument and the arteries I sent from North America to the late Dr. Hooper, and they ought to be in the museum of King's College.

CASE 120, by Staff-surgeon Collier.— William Ball, 44th regiment, aged twenty, was wounded by a spear or sword, on the 17th of June, which passed in at the angle of the left jaw, and penetrated the mouth, lacerating the tongue severely in three or four places. He was brought into hospital in Brussels on the 19th, and had, by his account, lost a considerable quantity of blood on the way. On the evening of the 22nd I found arterial blood jetting up with considerable force from the bottom of a narrow deep wound, and flowing in different directions as if from several branches of the external carotid. I attempted dilatation; but as all efforts to trace the sources of bleeding were fruitless, I applied steadily and forcibly graduated compresses, moderating the flow of blood by pressure on the carotid. Although the hemorrhage yielded for three or four minutes, it was soon evident it had only changed its channel, for it began to flow as furiously through the mouth as it had before done through the wound, and the coagula required to be constantly removed to prevent suffocation. My opinion being, that the patient's preservation depended on securing the common carotid artery, I performed the operation at eight o'clock that evening; the hemorrhage ceased the instant the ligature was applied. In two hours after the operation, the patient was quite tranquil and sensible; the pulse feeble; countenance very pale. On the following morning (23rd) I found him perfectly sensible and easy, with the exception of some sense of heat in the throat, rather increased since the operation; the pulse was 96, with slight sharpness; no appearance of hemorrhage. On the 5th of July the ligature came away, and on the 12th of August he was discharged cured, having suffered only from two slight attacks of erysipelas of the face, which gave no uneasiness.

CASE 121, by Mr. Mayo.—John Webb, aged twenty-three, was admitted into the Middlesex Hospital on the evening of the 18th of October, in consequence of a great loss of blood from an ulcer in the right side of the throat, which returned with such violence the next morning, the 19th, as to cause Mr. Mayo to place a ligature on the right common carotid, which arrested the bleeding. On the 3rd of November, the fifteenth day after the operation, the ligature came away from the artery. The ulcer of the pharynx had begun to cicatrize, and the patient shortly afterwards recovered.

CASE 122, by Mr. Luke.—T. B., aged forty-five, a tall muscular man, was affected by sore throat for three weeks, and was awakened in the morning by something flowing from his throat, which proved to be blood, of which he lost four pints before it stopped. On the 3rd of October, three days afterwards, the bleeding returned, but soon ceased. In about a quarter of an hour he had lost between three and four pints of blood. October the 4th.—At 4, a. m., bleeding again returned. The patient was sensible, but apparently indifferent to surrounding objects. He had lost at this bleeding more than three pints of blood, and it seemed almost certain that he must die if another bleeding should take place. Mr. Luke therefore tied the carotid artery on the left side, that being the trunk which the circumstances of the case indicated to be the source of the bleeding vessel. The operation succeeded in stopping the bleeding, which recurred once, seven days after the operation, to the amount of two ounces. The two ligatures, which had been applied about half an inch apart without dividing the artery between them, came away on the twenty-second day after their application, and the patient perfectly recovered.

CASE 123.—I was sent for into Jermyn-street to see a gentleman, who in a moment of great anxiety of mind had cut his throat with a razor, and fell bathed in blood. The bleeding was arrested by thrusting sponges into the wound. The cut had been made with great violence across the throat, but was deepest on the left side, having laid bare the left carotid, and wounded the internal jugular vein, from which the principal bleeding came. The opening in the vein being distinct, I passed the point of a tenaculum through the edges made by the cut into it, and drawing them together in this manner, passed a single silk thread around so as to close the opening, without destroying the continuity of the vessel. The ends of the ligature were cut off close to the knot. The carotid was then clearly seen by the side of the vein, having a transverse mark or cut upon it, which did not appear to penetrate beyond the middle coat; and after due consideration, it was presumed that this wound might heal, without requiring a ligature to be placed upon the artery. On the eighth day arterial hemorrhage took place, and on opening the wound it came evidently from that part of the carotid which had been cut. I placed a ligature upon the common carotid immediately below this opening, but the flow of blood was scarcely diminished in quantity by it, in consequence of the reflux from the head. On attempting to apply another ligature above the opening, I found, as I had before suspected from the situation of the wound, that it was immediately below the division of the common carotid into the external and internal carotid arteries. The hemorrhage ceased on placing a ligature on the external carotid, above the wound in the artery, and as the patient was greatly exhausted, I refrained from tying the other. The bleeding did not return, but he died the next morning from weakness.

On examination after death, the internal jugular vein was found pervious, and without a mark indicating where the ligature had been applied. The origin of the internal carotid was filled for about a quarter of an inch with a soft coagulum of blood; the remaining part up to its entrance into the skull was empty. The wound was exactly below the bifurcation of the artery, and the ligature on the external carotid might have been sufficient if the patient had lived.

This case will serve as a guide under similar circumstances. It shows that where an opening is made into a vein of the size of the internal jugular (its division not having been accomplished), a ligature may be made to include the cut portion without interfering with the canal of the vessel; and that where the two outer coats of a large artery are divided, it will be better to place a ligature above and another below the injured part at once, rather than leave it to the efforts of nature alone. A direct wound of the common carotid is usually fatal from loss of blood.

Case 124.—A soldier of the rifle brigade at Ypres, was wounded by a penknife in the throat, and bled profusely. Staff-surgeon Maling tied the common carotid above and below the wound, and succeeded in arresting the hemorrhage, although the patient did not eventually recover. The practice in such cases is clear, and ought to be decided.

In all cases of hemorrhage from the throat, which cannot be suppressed without tying the carotid artery, it is generally the external carotid which ought to be tied, and not the trunk of the common carotid. There is not sufficient reason for cutting off the supply of blood to the head by the internal carotid, unless the operation on the external should fail, when the common carotid may be tied as a last resource.

The common carotid artery has been tied several times for wounds inflicted on it, or on one of its two divisions, by foreign substances forced through the mouth into the tongue and throat. These persons have generally died from repeated bleedings, although some have recovered altogether, and others have failed and died ultimately from abscess in the brain, or after attacks of paralysis, caused by disease in that organ—the result probably of a defective supply of blood, of which Mr. Vincent has given the particulars of two cases in the *Medico-Chirurgical Transactions* for the present year.

Case 125.—Mr. Vincent tied the right common carotid of John Mason on the 18th July, 1828, for an aneurism. In the evening the patient suffered from convulsions on the same side, which continued, and were followed by paralysis of the left side. The man died on the 24th. The brain on the right side was found soft and disorganised.

Case 126.—Wm. Brown, aged twenty-eight, was wounded on the 9th April, 1845, by a tobacco-pipe, which, forced into the mouth, penetrated the root of the tongue on the right side. On the 16th great hemorrhage took place, which induced Mr. Vincent to place a ligature on the common carotid artery. Paralysis of the left side immediately followed, with twitchings on the right. On the 21st he died, and the brain was found softened and disorganised on the right, or the side on which the artery had been tied.

Case 127.—M. Sedillot, *Gazette Medicale*, September 3rd, 1842. Charles Muller, ten years old, was wounded by a very sharp knife below the right side of the jaw, near the ear; which bled very freely at times, until the 5th day, when Dr. Francois attempted alone to tie the carotid; bleeding ceased for three days, when it returned, and Professor Sedillot was called in consultation. The professor says, "I insist on every occasion on the importance of the precept, to tie wounded arteries above and below the part injured. One avoids by this a thousand accidents, and the greatest dangers. This time, in the midst of mortified and diseased parts, I thought it better to tie the primitive trunk, surrounded even as it was by parts altered by the induratory and suppurative process." Three hours afterwards, complete hemiplegia of the left side of the body and of the right side of the face appeared, and the patient died ten days afterwards. Dissection showed the external carotid open, with a wound in it, but not divided. Both ends had bled. The head having been injected from the left or opposite carotid, it was found that the portion of the right common carotid above the ligature contained injection, brought into it by the internal carotid, by the facial, and particularly by the superior thyroid, and some large branches anastomosing with the internal carotid of the opposite side.

*Remarks.*—With respect to derangement of the brain, Le Noir reports in the *Dictionnaire des Etudes Medicales* that out of sixty-five cases he had collected, three died of delirium and convulsions, one of adynamia, four from hemiplegia. In two others the intellect was weakened, in three vision was rendered defective on the opposite side, the brain showed a want of blood, and a softening of the right anterior lobe.

Case 128, by Dr. Twitchell, of Keene, N. H., United States.—A soldier in a sham fight, in 1807, received a wound from the wadding of a pistol on the right side of the head, face, and neck, which were much burned. A large wound was made in the mouth and pharynx; nearly the whole of the parotid gland, with the temporal, masseter, and pharyngeal muscles were destroyed. The neighbouring bones were shattered, and the tongue injured. The hemorrhage was not copious, although the external carotid and its branches were divided. Ten days after the accident the sloughs had all separated, and left a large circular aperture of from two to three inches in diameter, at the bottom of which might be distinctly seen the internal carotid artery denuded from near the bifurcation of the common trunk to where it forms a turn to enter the canal in the temporal bone. Directly on this part there was a dark speck of a line or two in diameter, which suddenly gave way whilst Dr. Twitchell was in the house. With the thumb of his left hand, he compressed the artery against the base of the skull, and effectually controlled the hemorrhage. The patient fainted. As soon as he was recovered, the doctor says, "I proceeded to clear the wound from blood, and having done this I made an incision with a scalpel downwards, along the course of the artery, to more than an inch below the point where the external branch was given off, which, as stated above, had been destroyed at the time of the injury. Having but one hand at liberty, I depended upon the mother of the patient to separate the sides of the wound, which she did, partly with a hook, and occasionally with her fingers. At length, partly by careful dissection, and partly by using my fingers, and the handle of the scalpel, I succeeded in separating the artery from its attachments, and passing my finger under it, I raised it up sufficiently for my assistant to pass a ligature round it. She tied it with a surgeon's knot, as I directed, at about half an inch below the bifurcation." Dr. Twitchell removed his thumb, and sponged away the blood, not doubting that the hemorrhage was effectually controlled; but, to his surprise and disappointment, the blood immediately began to ooze from the rupture in the artery, and in less than ten minutes it flowed with a pulsating jet. He compressed it again with his thumb, and began to despair of saving his patient, but resolved to make another attempt. Raising his thumb, he placed a small piece of dry sponge directly over the orifice in the artery, and renewed the compression till a rather larger piece of sponge could be prepared. He placed that upon the first, and so went on pressing the gradually enlarged pieces obliquely upwards and backwards against the base of the skull, till he had filled the wound with a firm cone of sponge, the base of which projected two or three inches externally. He then applied a linen roller in such a manner as to press firmly upon the sponge, passing it in repeated turns over the head, face, and neck. On the 30th of December he was discharged cured, several fragments of bone and two teeth from the upper jaw having been cast off. Some deformity remained, in consequence of the depression on the side of the face.

*Remarks.*—This case shows very distinctly how readily the internal carotid can bring its reflux blood into the common trunk, whence it may ascend against gravity in the external carotid, and renew the bleeding, even if it should not be done by other anastomosing branches, as in Case 128.

CASE 129.—Dr. J. M. Warren, of the Massachussetts General Hospital, tied the left carotid, on the 5th of October, 1845, for a case of erectile tumor of the lower lip and tongue, which had supervened on a mark occupying nearly the whole of the left side of the face and head. The patient recovered, and considerable diminution of the swelling followed. On the 7th of November, the right carotid was tied, the vessel being dilated to one-third more than its natural size; slight faintness and drowsiness followed the operation, and the patient recovered without further inconvenience. After some other operations about the part affected, the patient returned home cured. No pulsation could be discovered in the temporal, nor in any arteries of the head. In the neck, just above the clavicle, two large arteries were seen pulsating under the skin, being in all probability the suprascapulares greatly enlarged. No affection of the brain followed the double operation.

Wounds of the hand and foot, accompanied by hemorrhage, and which may be considered to be deep-seated wounds, are often exceedingly troublesome. The same rules are however applicable to them—dilatation of the wound, and ligature of the vessel; or if this be not practicable, or be unsuccessful, compression on the principal trunk, and a graduated compress and bandage on the wound. The ulnar artery when wounded in the palm of the hand ought always to be secured by ligature. The radial being more deeply seated requires more precaution; and when an incision cannot be made of the necessary extent without injuring the median nerve or its branches, so as to paralyse the fingers, compression of both kinds should be tried. If the swelling of the hand will not admit of it, the radial artery should be first tied, and compression made on the ulnar, or a tourniquet may be applied on the brachial from time to time, and as a last resource, the ulnar artery must be tied also, but no one should rely on tying the brachial in the first instance; for, although such operation has succeeded, and may again succeed, it does so only by chance, and not by principle; inasmuch as the principle is that the collateral circulation should restore the bleeding. If the bleeding recur in spite of this and of the graduated compress, so applied as not to compress the whole hand, but only the bleeding part, and the swelling of the hand will not admit of its reapplication, the hand is still not to be amputated, but a clean and decided incision is to be made in the line of the wound, from the annular ligament to the finger (avoiding the flexor tendons), and down to the metacarpal bone, which bone and finger is *if necessary* to be removed; by which space will be obtained to see the bleeding vessels. The hand is only to be amputated as a last resource. The foot is to be treated in a similar manner. I have seen many cases of hemorrhage from both; but I never saw either removed in consequence of it.

It is in wounds of that part of the radial artery where it dips into the hand that surgeons have had most inclination to place a ligature on the brachial artery. My excellent friend, Sir G. Ballingall, says on this point:—"In two such cases I have successfully had recourse to the ligature of the humeral artery; and I have known the same operation twice executed with success by others. This is a practice which some will think more honoured in the breach than the observance; and it has I know been said, that there is no hemorrhage from vessels in the hand or foot which may not be restrained by pressure. This I believe may be true; but, on the other hand, I believe it to be equally true, that in certain states of a wound or ulcer the healing process will not go on nor the closure of the vessel take place under that degree of pressure which is necessary to suppress the bleeding; and it is by checking the flux of blood to the part, without irritating or inflaming the wound itself, that I believe the ligature of the artery above to operate favourably in such cases."

When the ulnar artery is wounded a little below its origin, and whilst covered by the pronator teres, and the superficial flexors of the forearm, viz., the flexor carpi radialis, palmaris longus, and flexor digitorum sublimis, the artery is to be secured at tbe part injured by two ligatures. A most excellent writer on the arteries, and whose book as an anatomical work is invaluable, says, page 215, "In the superior third of the forearm, the great depth at which this artery lies from the surface, and the number of muscles which cover it, render it impracticable to pass a ligature around it." A very simple question naturally presents itself—why is it impracticable? The answer is, it cannot be laid bare unless the muscles named above be divided; but to the question why this should not be done, it would be difficult to reply, unless it be honestly answered, there is no reason why it should not be done, other than that it has not been usual to do so.

I shall refer to a case in point.

CASE 130.—The surgeon says, "I was consulted in the following circumstances: — A child having a sharp pointed knife in its hand, had wounded the nursery maid below the elbow, and close to the ulna. The ulnar artery was wounded near its origin from the brachial artery. It bled profusely, and the surgeon tied the main artery by the side of the tendon of the biceps muscle. This stopped the hemorrhage for a time, but afterwards it returned from the wound. The ulnar artery was then tied below the wound, for it was apparent that the blood returned from below. What was next to be done if it should again bleed? Tie the radial artery. But it did not return. We see however the difficulties which overtake us when the primary branches are wounded near their trunks, and the surgeon will have to determine the propriety of tying the trunk, or of enlarging the wound, and tying the bleeding orifices. In this case there might have arisen a necessity for three operations instead of one. As it happened, it was dexterously done, and happily."

*Remarks.*—As there is no name given with this case, and I cannot hurt the feelings of any one by my remarks, I shall take the liberty of saying there never was anything done so directly contrary to the principles of surgery, in regard to wounded arteries. In the first place, for a wound of the ulnar artery, the brachial was tied, thus applying the Hunterian theory of aneurism to a wounded artery. In the second place, the ulnar artery was tied in a similar manner, some two or more inches below the wound, being a more pardonable error of the same kind. This operation succeeded, because the collateral branches had not time to bring the blood into the arteries below the ligature on the brachial, and above that on the ulnar artery, before they were closed by the inflammatory and natural processes. This case therefore furnishes another proof of the fallacy of the opinions on the collateral circulation which I have just exposed. The reporter does not however stop here; he comments upon it, by inquiring what was next to be done, if it had bled again?—and replies himself to the question—Tie the radial artery. Now it would be difficult to conceive why the radial artery should be tied for a wound of the ulnar, if the surgeon were not alarmed at the thought of dividing muscular fibres, in which the only difficulty lies. In order to avoid dividing muscular fibres, a separate and distinct artery is to be tied; and what could that operation have done? on what principle could it be useful? By tying the radial artery, the return of blood through it into the humeral end of the ulnar might have been prevented. But it would not *certainly* have been prevented, because there are radial, and ulnar, and interrosseal recurrents, all returning blood, or capable of doing it, after the lapse of a few days, into the cut and open extremities of the artery, and they might all require to be tied in succession. If the opinions entertained on the subject of the collateral circulation by its strongest advocates be correct, they must and would all have required it.

The error in this case was original. The surgeon should have made a clean incision down to the artery, through all the muscular fibres interposed between it and the surface, avoiding the median nerve, which runs between the two origins of the pronator teres muscle, and then he should have placed a ligature above, and another below the wound in the artery, and there would have been nothing more to do.

The person's life was endangered, two operations were done, and a third, and probably amputation as a last resource, were only avoided by an accidental circumstance, viz., that the cut end of the artery became impervious before the recurrent and collateral branches brought their blood round into it; and all this was incurred merely that a few muscular fibres might not be divided. It is necessary now to ask, what would be the consequence of this division? The utmost consequence which could ensue would be weakness of the arm in the performance of certain motions; but I have no hesitation in affirming that no such consequence would ensue. I have seen the parts divided—nay, I have divided them myself—and the patient has recovered without any sensible defect.

These remarks are taken altogether from my work published in 1830. I could not make them stronger or more effectively convincing to those who will allow themselves to be convinced.

Wounds inflicted on arteries in bleeding ought to be treated on the principles laid down for the management of wounded arteries generally. Whenever an accident of this kind occurs at the bend of the arm, and the bleeding cannot be effectually restrained by compress and bandage as in cases 1, 2, &c, an incision should be made down to the artery, and one ligature applied above and another below the wounded part. It is almost always the brachial artery that is wounded, and not the ulnar or radial, unless the latter is given off high in the arm. This practice would be seldom followed by any bad or unfavourable result, if it were immediately adopted; but as the error is usually made by persons incompetent to the performance of the operation, the bleeding is in the first instance restrained by pressure, until its repeated recurrence renders other assistance necessary. The arm is then, in all probability, more or less injected with blood, inflammation has taken place, the constitution can scarcely have failed to sympathise, and the operation under these circumstances is frequently ineffectual; amputation follows, and death. The following case may serve as an example:—

Case 131.—A poor man had the artery opened at the bend of the arm in bleeding, and the operator, suspecting the accident he had committed, applied a compress and bandage to restrain the hemorrhage, which nevertheless recurred several times; on which he was sent to the hospital, with the arm inflamed, swelled, and injected with blood. The brachial artery was tied close to the wounded part, but as the bleeding returned, it was again secured a little higher up; but, as hemorrhage again took place, amputation was had recourse to, and the patient died exhausted.

*Remarks.*—On dissection, the brachial artery was found to be the vessel injured, immediately at its bifurcation, so as scarcely to allow of a ligature being applied to the trunk below. In this case, three ligatures would perhaps have been required in the first instance, one on each artery, viz., the trunk of the brachial, and the commencement of the radial and the ulnar arteries. I have preserved the parts. When the wound in the artery is of a small size, an operation is not always required, but that can be rarely ascertained until it is found that the injury is not followed by bad symptoms. When an operation is not performed, and pressure is applied, it is possible that the wound in the artery may heal, but this does not usually take place, and an aneurism is the consequence. This may be of two kinds—circumscribed or diffused. If the artery has been punctured below the bend of the elbow by an operation on the median basilic vein, the aponeurosis of the biceps muscle is interposed between the vein and the artery, and will tend under pressure to confine the effused blood, so that at last the inflammatory process will consolidate the surrounding parts, and, if the external wound close, give rise to a circumscribed aneurism. For this, if some weeks have elapsed, the operation of placing a ligature on the trunk of the artery may be had recourse to as near the aneurism as possible, the principal reason for doing it at a distance, viz., the diseased state of the artery, being wanting; and one ligature will be sufficient.

When the artery is wounded above the edge of the aponeurosis of the biceps, and the external wound closes, the effused blood may extend upwards in the course of the vessel, so as to form a diffused aneurism. These injuries are now of rare occurrence in England, and my opportunities of seeing them have not been so frequent as to enable me to lay down rules for their treatment with that confidence with which I write on all other points. I shall therefore refer to the best authority I know—to the recorded opinion of the late Dr. Colles, of Dublin, as stated by Mr. Harrison,—accidents of this kind being apparently more common in that city and in its vicinity than in London and its neighbourhood. He says, "I have operated repeatedly, and with success, for the cure of brachial aneurism, in consequence of injury to the artery in performing venesection. I have also frequently assisted others in operating for the same cause, and with the same result; and I never yet found it necessary to open the aneurismal sac, or to look for the vessel below the tumour, or to apply more than one ligature around the artery, and which I think ought always to be tied as near as possible to the seat of the disease." This method of treatment, combined with moderate pressure along the aneurismal sac, the horizontal position, and if necessary active depletion, will rarely fail of success. It should, however, be borne in mind that if the surgeon on committing the error applies his compression on the artery in a methodical manner, and before any extravasation takes place into the surrounding parts, he will rarely fail of success, as in case No. 1.

If the wounded vein should adhere to the cut edges of the wounded artery—leaving a direct communication between the one and the other—the blood is propelled into the vein, enlarges it, and constitutes what is called an *aneurismal varix*. But if there be any cellular texture interposed between the opening in the artery and vein, yet communicating with both, it gives rise to the change of denomination to *varicose aneurism*. Neither of these complaints, which are essentially the same, requires an operation in the generality of instances; after attaining a certain size and appearance, they often remain stationary through life. When either from the increase of size of the swelling, or the anxiety of the patient, an operation is considered necessary, it should be done by incision at the part, and the application of two ligatures to the artery; for although in some cases one has been found sufficient, the records of surgery furnish abundant proof that blood has been returned to the sac by the anastomosing branches, and a second operation has been required to effect a cure, the conclusion to which M. Amussat has arrived and declared in his memoir, inserted in the *Journal de Chirurgie* of M. Malgaigne, for 1843.

# LECTURE VIII.

*General Conclusions; The operations for placing a ligature on the aorta, the common trunk of the iliac, and on the internal and external iliac arteries; The operations for placing a ligature on the gluteal and sciatic arteries; The operations on the femoral artery.*

The very great inconvenience these lectures have given me at this season of the year, causes me to defer the remaining four until the autumn, when I will make the four, eight, with the hope you may reap some advantage from the additional number. By the rules of this hospital the surgeons must all be, or have been, teachers or demonstrators of anatomy, or surgeons or assistant-surgeons of hospitals devoted to cases of general surgery. The ground on which it is built, is held on the condition that lectures on general as well as on ophthalmic surgery, shall be given to the medical officers of the public service from time to time, and that the hospital shall always be open to their attendance on the recommendation of the heads of their respective departments. It is the duty of the surgeon to give notice when he intends to begin these lectures, and you may rely upon its being given as a part of that duty. I am obliged by the attention you have paid, and shall be glad hereafter to see as many as may please to attend. You are all aware, however, that it is indifferent to me whether there are three, thirty, or 300, as I am not lecturing for money, and I never disallowed the attendance of any one, when I did do so.

I have brought together certain precepts, with which I shall conclude these lectures; I had intended to have gone through the principal operations with you, but there is not sufficient convenience here at this hot season, and I really have not time to spare. I shall give the description of them to the reporter, who will publish them if he sees fit.

## GENERAL CONCLUSIONS.

1. The Hunterian operation for the cure of an aneurism is not applicable to the treatment of a wounded artery, inasmuch as the wound of the artery communicates with the external parts, and nothing intervenes to prevent blood flowing from the wound in its side, or from its cut extremities.

2. When a large artery is divided and bleeds, the wound should be enlarged if necessary, and a ligature placed on both the divided ends; but if the artery be only injured and not quite divided, the ligatures should be applied one immediately above, the other below the injured part. The artery may or may not be then cut across, at the pleasure of the operator, but the limb or part should be placed in a relaxed position. A bandage should not be applied, and the edges of the wound should be simply brought together by adhesive plasters, which do not extend completely round the limb.

3. No operation is to be performed on any artery unless it bleeds at the moment of its performance, inasmuch as hemorrhage once suppressed may never return.

4. The intervention of muscular fibres, or of whole muscles, is not a sufficient reason for tying the artery at a distant part. They must be divided, if it be possible, to the extent required for a due exposure of the injured artery and its accompanying veins and nerves.

5. If the wound pass indirectly to the principal artery, from the back of the thigh for instance to the femoral artery in front, or from the outside of the arm to the humeral artery on the inside, the surgeon may (on satisfying himself of the part likely to be injured, by the introduction of a probe) cut down on the vessel opposite the part supposed to be wounded, by the most simple and approved method. When the artery is exposed, the probe will point out the spot at which the vessel has in all probability been wounded. Pressure made below this spot on the artery, will cause it to be distended and to bleed, if the flow of blood be not prevented from above; the artery is then to be secured by two ligatures, and the lower one should if possible be applied first.

6. The tourniquet should never be used in an operation for aneurism or for a wounded artery. Compression by the hand in the course of the wounded vessel is allowable.

7. The blood from the upper end of a divided artery, or that nearest the heart, is of a scarlet arterial colour.

10. The blood from the lower end of a divided artery, or that which is furthest from the heart, is of a dark or venous colour, when it happens to flow immediately after the division of the vessel. At a subsequent period it may assume more of the colour of arterial blood, but it rarely does so for several days after the receipt of the injury, and always flows, or at least until a very late period, in a continued stream.

11. This regurgitation or flow of blood from the lower end of a divided artery is a favourable sign, inasmuch as it shows that the collateral circulation will probably be sufficient to maintain the life of the extremity.

12. The collateral circulation is in almost every instance capable of maintaining the life of the upper extremity when the axillary artery is divided, and the colour of the blood which flows from the end of the artery, on its being divided, is not always as dark as in the lower extremity, and it sooner resumes its arterial colour.

13. The collateral circulation is not always capable of maintaining the life of the limb when the femoral artery is injured. The best assistance which art can give is to rub the foot and leg in the gentlest manner, between the hands of one or two strong young women, for several hours, or even for the first three or four days; relaxing this process very little, even during sleep. When the vein is divided at the same time, or rendered impervious, the limb usually mortifies.

14. The collateral circulation is sufficient to maintain the life of an extremity in almost every case in which an aneurism has existed for eight or ten weeks, although it may be incapable of doing this if the principal artery have been suddenly divided, without any previous disease having existed in the part.

15. The theory and the operation for aneurism are never to be applied to the treatment of a wounded artery, which has caused a diffused or circumscribed aneurism, *whilst the external wound communicates with the artery*, unless it be impossible or impracticable to tie the bleeding vessel.

16. When an artery has been wounded, and the external opening has healed for weeks or months, so as to give rise to a diffused or circumscribed aneurism, it may be treated according to the theory of aneurism occurring from an internal cause, if the case will permit it without danger; although with this difference, that as the artery is sound the operation may be performed close to the tumor. If any doubt exist as to the capability of the collateral circulation to support the life of the lower extremity, after the external iliac has been secured by ligature, the operation should be performed at the injured part by opening the swelling and enlarging the wound, as in the case of a wounded artery.

17. When a circumscribed or diffused aneurism which has formed after a wound has been opened, whether by accident or design, it is placed in the situation of a wounded artery, and should be treated as such. If the aneurism has arisen from disease of the vessel, and the wound or opening into it cannot be permanently closed, the limb is in a worse state than if the artery had been wounded by accident; because a ligature or ligatures placed on a diseased artery are little likely to be successful. They are liable to all the difficulties and inconveniences attendant on the old operation for aneurism. If a case of the kind should occur in a popliteal or femoral aneurism, situated at or below where the artery passes between the triceps and the bone, amputation, if it can be done low down, will be the best remedy. If the aneurism should have formed higher up, and the opening can be closed with any prospect of its healing, a ligature may be placed upon the artery above it; but on the recurrence of hemorrhage which cannot be restrained by moderate pressure, the artery must be tied below, or recourse had to amputation. It is, however, to be observed, that amputation under these circumstances, when resorted to as a third operation, rarely succeeds.

18. When an artery is wounded with a simple fracture of a bone, or with a comminuted fracture of smaller bones, with an external communicating opening, both ends of the artery should be secured, and the limb treated in the usual manner.

19. When the bone broken is the femur, and the artery divided is the femoral artery, the operation of amputation will generally be advisable. It will always be so if the fracture is a comminuted one, or the shaft of the bone is extensively splintered.

20. When the broken bone injures the artery and gives rise to an aneurism, the treatment is to be first of the fracture and then of the aneurism, as soon as circumstances render it advisable or necessary to have recourse to the operation for aneurism; which can only be after time has been given for the collateral branches to enlarge, so as to maintain the life of the limb.

19. When mortification takes place in addition to, or as a consequence of a wounded artery, amputation should be had recourse to forthwith.

20. The place of operation should be in almost all cases at the seat of the original wound; but there may be an exception, viz.,

21. When, for instance, the injury has been a mere cut, just sufficient to divide the artery and vein immediately below Poupart's ligament, and mortification of the foot supervenes, amputation should then be performed below the knee, or at the part where the mortification more usually stops for a time, as in Case 96.

This rule is founded on the observation, that great efforts are made by nature to arrest mortification a little below the knee. Sometimes they succeed; when they fail, death is almost inevitable. The advice to amputate at this part is founded on the fact of its being infinitely less dangerous, when done there, than on the thigh, independently of saving a joint.

22. When mortification has *continued for several days*, and is spreading without having once stopped, the constitution of the patient being implicated as marked by fever, amputation should not be performed until the mortification has been arrested and the line of separation has been well formed. In many cases, where there is great weakness or of irritability of constitution, it will be advisable to defer the operation to a later period, particularly if there be hope of the patient's becoming stronger and more tranquil.

23. If the mortification has once stopped and

then begins again to spread, it will never again cease to extend, and amputation may give some chance of life.

24. Amputation of the arm should never be had recourse to, in consequence of a wound of the axillary artery, unless mortification takes place.

25. When mortification takes place after the operation for aneurism, the surgeon must be guided by the state of the patient's constitution, in resorting to or refraining from amputation.

26. When hemorrhage occurs from the surface of a stump, the artery should be tied at the part from which the blood comes in the first instance, if it can be easily done. If this should not suffice, the artery must be tied higher up, just at such distance as will afford a fair hope of its not having been affected by the derangement of the stump, which has led to the failure of consolidation in the extremity of the artery; yet not too high to admit of the junction of any large collateral branches. If the bleeding proceeds from several small vessels, and cannot be arrested, the principal trunk should be tied immediately above the diseased part, and the patient removed to a purer atmosphere, without which an operation rarely succeeds in any case.

27. When an aneurismal tumor mortifies, it is unnecessary and improper to tie the artery above the tumor, because it will be obliterated if the mortification be arrested by the efforts of nature, which the operation may interfere with, and even prevent, whilst, if the mortification spreads, it will be a matter of supererogation, and only hasten the patient's dissolution. When an aneurism inflames, is opened by ulceration, and bleeds profusely, so as not to be arrested, it is a proper case for amputation, if such an operation can be performed.

### *On the Operations of placing a Ligature on the Aorta, on the Common Trunk of the Iliac, and on the Internal and External Iliac Arteries.*

In performing either of the three operations, it is advisable to compute the point at which the artery is to be tied, with relation to the umbilicus and the anterior superior spinous process and the crest of the ilium. The aorta bifurcates usually on the body of the fourth, or on the intervertebral substance between it and the fifth vertebra, although it may be higher or lower, which cannot be ascertained previously to the operation; the most usual place being nearly opposite to the margin of the umbilicus on the left side. It is about half an inch above this that the ligature should be placed on the aorta, if this operation is ever done again, rather lower than higher, on account of the origin of the inferior mesenteric artery. As the aorta is to be reached by carrying the finger along the common iliac, the comparative situation of that vessel is next to be estimated.

The aorta divides into the two common iliac arteries, the length of which varies according to the stature of the patient, and the place at which the aorta bifurcates. The common iliacs again divide into the external and internal iliacs, which division is usually opposite to the sacro-iliac symphysis. The length of the common iliac artery is therefore tolerably well defined, as scarcely ever exceeding two inches and three quarters, and seldom being shorter than two inches. The external iliac is a little longer than the common iliac, and the place of subdivision of the common iliac into external and internal can always be ascertained during an operation, by tracing the external iliac upwards to its junction with the internal iliac to form the common trunk, which proceeds upwards and inwards to the aorta. The left margin of the umbilicus being taken as a point opposite to that which may be presumed to be the part at which the aorta divides, and the situation of the external iliac becoming femoral being clearly ascertained, a line drawn between the two will nearly indicate the course of these vessels; sufficiently so at all events to enable the operator to mark with his eye the place where he expects to tie the artery, and to regulate the length of the incision, so that this ideal spot may correspond to its centre. It is necessary to recollect also, that the whole of one hand and part of the other must be introduced into the wound, to enable the operator to pass the ligature round the artery, and to tie the knots; so that an external incision of less extent than five inches will not suffice, and six will afford a facility in operating, which will save pain to the patient, and inconvenience to the operator. In calculating the length of the incision, allowance must be made for the size, obesity, and muscularity of the patient. If a rule be placed on the crest of each ilium, about one inch and a half behind the anterior superior spinous process, it will pass in a well-formed man across the junction of the fifth lumbar vertebra with the upper part of the sacrum, and a little way behind where the common iliac divides into external and internal. The centre of an incision, six inches in length, beginning about half an inch above Poupart's ligament, and about the same distance to the outside of the inner ring, and carried upwards, will fall nearly on a line with this point. The incision should be nearly parallel to the course of the epigastric artery, but a little more to the outside, in order to avoid it and the spermatic chord, and having a gradual inclination inwards towards the external edge of the rectus muscle, the patient being on his back, with the head and shoulders raised, and the legs bent on the trunk. The aponeurosis of the external oblique muscle having been opened inferiorly, is to be slit up for the whole length of the external incision; and the director having been first passed under the internal oblique muscle, through a small opening carefully made into it, it is to be divided in a similar manner. The transversalis is then to be cut through at the under part, and its tendinous expansion divided at the upper part, the greatest precaution being taken by the finger to prevent the peritoneum from being injured. The fascia transversalis is then to be torn through at the lower and outer part, so that the fingers may be passed inwards from the ilium, and the peritoneum detached from the iliac fossa, and turned with its contents inwards, by a gradual and sidelong movement of the fore and second finger inwards and upwards, until passing over the psoas muscle the external iliac artery is discovered by its pulsation. It is then to be traced upwards and inwards towards the spine, when the origin of it and the internal iliac from the common trunk will be felt. The point of the forefinger will then be nearly in the centre of a line drawn from the umbilicus to the anterior superior spine of the ilium ; and hence the necessity for an incision of six inches in length, if the artery is to be tied high up, which is to be accomplished by tracing it in a similar manner to its origin from the aorta.

If the *internal iliac* is to be tied, the operator traces it downwards from its origin, in preference to passing his finger from the external iliac artery inwards in search of it. Having placed the point of his fore finger on the vessel at the part where he intends to pass his ligature, he scratches with the nail upon and on each side of it, so as to separate it from its cellular attachments, and from the vein which accompanies but lies behind it. Thus far the operator proceeds by feeling; but it is now necessary that the sides of the wound should be separated, and kept apart by blunt spatulæ curved at the ends, so as take up as little space as possible, and not injure the peritoneum. The surgeon should if possible see the artery, and the ligature carried on the eye of a bent probe, or a convenient aneurismal needle, should be passed under it from within outwards, when it should be taken hold of with the forceps; the probe or needle should then be withdrawn, and the ligature firmly tied twice, or with a double knot. Great care must be taken to avoid every thing but the artery. The peritoneum which covers it, and the ureter which crosses it, must be particulary kept in mind. The situation of the external iliac artery and vein, which have been crossed to reach it, must be always recollected, and if there be sufficient space they should be kept out of the way, and guarded by the finger of an assistant.

The *common trunk* of the iliac arteries and the aorta itself may be tied by the same method of proceeding; the only difference which can be practised with advantage will be to make the incision a little longer at its upper part; no inconvenience arising from the addition to the length of the external wound, whilst the subsequent steps of the operation are much facilitated by it. The following method of proceeding, adopted in cases 31 and 108, will bring the method of operating so graphically before the reader that it cannot be misunderstood, and may be readily followed in operating. I began the operation, the patient lying on the back, by an incision on the fore part of the abdomen, commencing an inch and a-half below the inside of the anterior spine of the ilium, and the same distance within it, carrying it upwards, and diagonally inwards towards the edge of the rectus muscle above the umbilicus, so that the incision was between six and seven inches long. If the incision is made more outwardly, towards the side in a straight or vertical line from the ilium towards the ribs, great difficulty will be experienced in turning over the peritoneum with its contents, so as to place the finger on the last lumbar vertebra, an inconvenience which will be avoided by making the incision diagonally and of the length directed.

After dividing the common integuments, the three layers of muscles were cut through in the most careful manner ; the division of the transversalis muscle was attended with some difficulty, inasmuch as there was little fascia transversalis, and the peritoneum was remarkably thin—as thin as white silver paper. On attempting to reach the under part on the inside of the ilium, so as to turn the peritoneum over, which in sound parts is always done without the least difficulty, I found that it could not be done on account of the tumor which projected inwards adhering to it, and some bleeding took place from the large veins which surrounded it, giving rise to the caution not to proceed further in that direction. At this moment, in spite of the greatest possible care that could be taken by Mr. Keate, who raised and protected the peritoneum, a very small nick was made in it, sufficient to show the intestine through it. Perceiving that I could not tie the internal iliac as I had at first intended, and that I must place the ligature on the common iliac, I tried to gain a greater extent of space upwards ; but where the tendon of the transversalis muscle passes directly across from the lower ribs to aid in forming the sheath of the rectus, the peritoneum is usually so thin and so closely attached to it that it can only be separated with great difficulty. I knew this from the operation I performed in case No. 108, when, in spite of all the precaution I could then take, the peritoneum was at this spot slightly opened. It occurred in the present instance, and the right lobe of the liver was thus exposed.

The opening thus made on the fore part of the abdomen was not large enough to admit two hands. The peritoneum being however separated a little from the posterior wall of the abdomen from the outside, by the fingers, for a cutting instrument is inadmissible, four of the fingers of one hand were introduced beneath it, and it was turned a little over towards the opposite side. In doing this it must be remembered that the peritoneum must be raised, the hand being pushed towards the back as little as possible, in order to avoid getting behind the fat commonly found in that part of the body, which would lead to the under edge of the psoas muscle instead of the upper surface, and thus render the operation embarrassing.

The peritoneum being carefully drawn over with its contents, I found I could only get one hand, or a little more underneath it in search of the artery, the tumor below preventing any further detachment of the peritoneum in that direction. I therefore passed my finger across the psoas muscle, and it rested on the fifth lumbar vertebra. The common iliac artery was not however to be felt even as high up as the fourth lumbar vertebra, nor the aorta; they had both risen with the peritoneum, and my finger resting on the spine was beneath them. Mr. Keate endeavoured to raise or draw over the peritoneum, to give me an opportunity of seeing the vessels, but this was out of the question. In doing this, he felt the pulsation of the iliac artery, which had been raised with the peritoneum, to which I found it adhering. Carefully separating it with the end of the fore finger of the right hand, I passed a single thread of strong dentists' silk, as it is termed, in a common solid aneurismal needle by the aid of the thumb and fore finger of the left hand, round the artery without seeing it. I could bring the artery a little forward by means of the aneurismal needle, when it appeared to be perfectly clear, and from the distance of the bifurcation of the aorta above, I calculated that the common iliac was tied exactly at its middle part. All pulsation below immediately ceased.

The two ends of the ligature were twisted, the peritoneum replaced in its proper situation, care being taken that the two small openings into it should be well covered under the skin, so that they might not be in the line of the incision, and that they should be covered by newly divided healthy parts, which might thus adhere to each other. Three strong sutures and three or four smaller ones were put in through the skin, in order to prevent the parts bursting asunder from the movements of the patient. This operation was only formidable, as a whole, from the circumstance, that space could not be obtained for the introduction of both hands, for, strange as it may appear, the safety of, and ease in doing the operation, depends on the first incision in the fore part of the abdomen being so large that the peritoneum containing the bowels may be freely drawn over by the expanded hands or the assistant, so that the operator can see what he is doing beneath. In case No. 107, the whole of the parts under the peritoneum could be seen distinctly, and several gentlemen not in the profession who were present, saw the common iliac artery in its natural situation. The aorta may be as readily tied by this mode of proceeding as the common iliac, and I am satisfied it is in this way such an operation ought to be performed, provided it becomes necessary to attempt it, which I suspect it will not be, for when an aneurism has been formed so high up that it prevents the application of a ligature on the side on which the disease is situated, the common iliac will be more readily tied above it, instead of the aorta, by performing the operation on the opposite or sound side of the body, for as a ligature can be applied with great ease on the sound side on the middle of the common iliac artery, it requires very little more knowledge and dexterity to pass over to the opposite or diseased side, and tie the artery above the aneurismal tumor, the size of which would have prevented the operation being done on its own or affected side. The placing a ligature on the aorta for an aneurism in the pelvis will thus be be rendered unnecessary—a most important result deduced from the operation described.

The patient suffered little or nothing from the operation, which was performed on Saturday; there was no augmentation of the pulse until Sunday evening, when it rose to 120; she then experienced some pain, which was materially diminished, although not altogether removed, by the abstraction of four teen ounces of blood. At four o'clock in the morning, Mr. Hancock, now surgeon to the Charing-cross Hospital, took away fourteen ounces more, after which she had not a bad symptom. The bowels were not moved for the first four days. The temperature of the limb diminished, but not much, which may be attributed to the method adopted in case No. 108. For the first time two persons constantly rubbed the limb night and day, and a hot brick or bottles of hot water, covered by flannel were applied to the feet, of the temperature of from 120° to 140°. One nurse rubbed the lower part of the limb, another the upper for three days and nights; if an interval of a few minutes elapsed a hot flannel was put on the limb. The friction was very slight, so as not to injure the cuticle. The patient occasionally dozed a little, but the same gentle friction was kept up. The ligature came away on the twenty-sixth day after the operation. The external incision healed very readily, but was followed by a herniary projection, requiring the support of an abdominal bandage.

The situation of the ureter and rectum on the left side in this operation, and of the ureter and the cœcum with its appendix on the right side, should be well understood, and it should be known that the ureter rises with the peritoneum. The relative situation of the common iliac artery and vein should be particularly attended to in passing the ligature around the vessel. On the left side the artery lies external and anterior to its commencement; on the right, the artery passes over the commencement of the vena cava and the left iliac vein, which do not follow the peritoneum when drawn towards the opposite side. The bowels should be thoroughly well evacuated before the operation is performed, but purgatives should not be given for some days after it has been done. The food should be liquid, and inflammation should be subdued by leeches, general bleeding, fomentations, and opium.

The *external iliac* artery has been so often and so successfully tied that a description of the two methods of proceeding commonly adopted will suffice, with a few additional remarks. The first, recommended by Mr. Abernethy, is in accordance with the operations on the common and on the internal iliac. The patient being laid on his back, with the shoulders slightly raised, and the legs bent on the trunk, an incision is to be made about three inches and a-half in length in the direction of the artery, and terminating over or a little above Poupart's ligament. The aponeurosis of the external oblique muscle will be exposed, and an opening being made into it, a director is to be introduced, and it is to be slit up to the extent of the external incision. The internal oblique and transversalis muscles, are then to be "nicked," so as to allow a director or the point of the finger to be introduced below them, when they also are to be divided, the finger separating them from the fascia transversalis and peritoneum. The fascia transversalis running from Poupart's ligament to the peritoneum is now to be torn through with the nail, immediately over the pulsating artery, and the peritoneum is to be separated by the finger and pushed upwards until sufficient room is obtained; which, in this as well as in all other operations on the iliac arteries, is sometimes difficult on account of the protrusion of the intestines covered by the peritoneum, when the patient is not sufficiently tranquil. The artery is yet at some depth, and covered by a dense cellular membrane, connecting it to the vein on its inside, and which must be torn through with the nail. The anterior crural nerve is separated from the artery by the psoas muscle, at the outer edge of which it lies. The aneurismal needle should be passed between the vein and the artery, and the point made to appear on the outside of the artery.

In this operation the ligature is placed on the external iliac, above where it gives off the epigastric and circumflexa ilii arteries; and as the operation is very much the same as that already described, with the exception of the incision being shorter and nearer to Poupart's ligament; it is obvious if it were found necessary from disease to tie the artery higher up, or even to tie the common iliac, that it might be done by merely enlarging the wound.

Another method has been recommended by Sir Astley Cooper, which is perhaps more followed where there is little doubt of the artery being sound. It offers the advantage of greater space, which enables the surgeon to see better what he is doing; but it does not so readily admit of the artery being tied high up, without the incision being extended upwards, so as to give more room for the introduction of the hand behind the peritoneum.

"The patient being placed in the recumbent posture, on a table of convenient height, the incision is to be begun within an inch of the anterior superior spinous process of the ilium, and is to be extended downwards in a semicircular direction to the upper edge of Poupart's ligament. This incision exposes the tendon of the external oblique muscle: in the same direction the above tendon is to be cut through, and the lower edges of the internal oblique and transversalis abdominis muscles are exposed; the centre of these muscles is then to be raised from Poupart's ligament; the opening by which the spermatic cord quits the abdomen is thus exposed, and the finger passed through this space is directly applied upon the iliac artery, above the origin of the epigastric and circumflexa ilii arteries. The iliac artery is placed upon the outer side of the vein; and the next step in the operation consists in gently separating the vein from the artery by the extremity of a director, or by the end of the finger. The solid curved aneurismal needle is then passed under the artery, and between it and the vein from without inwards, carrying a ligature, which being brought out at the wound, the needle is withdrawn, and the ligature is then tied around the artery, as in the operation for popliteal aneurism. One end of the ligature being cut away, the other is suspended from the wound, the edges of which are brought together by adhesive plaster, and the wound is treated as any other containing a ligature."

This method of operating will suffice when the artery is to be tied for an aneurism which does not extend as high as Poupart's ligament. When it does, the operator will be so much inconvenienced by it, whilst the sound part of the artery above the tumor will be so much in a hollow behind it in the pelvis, that a ligature will not readily be passed around it, and the disturbance to the peritoneum will be much greater, and much more likely to give rise to peritonitis, than if the incision were made an inch longer on the face of the abdomen. The surgeon, instead of searching for the artery, as Sir Astley Cooper has directed, through the passage by which the spermatic cord quits the abdomen, and thus passing the fingers directly under the peritoneum, will find it very much for his own ease, and for the advantage of his patient, to pass his fingers under the peritoneum from the inside of the wall of the ilium, from which it readily separates, and thus approach the artery from the outside, instead of from below. He will obtain more room, reach the artery easily above the origin of the circumflexa ilii, and avoid that disturbance of the peritoneum, in applying the ligature, which often leads to inflammation.

If the surgeon has unluckily divided the epigastric artery, either in this or any other operation, all that he has to do is to enlarge the incision, and tie both the divided ends; and I have no hesitation in saying, it will not be of any consequence, either in this operation or in one for hernia.

### *Of the Operation of placing a Ligature on the Gluteal or Sciatic Arteries.*

In all cases of aneurism of the gluteal and sciatic arteries, the internal iliac artery should be tied, instead of an operation on the part itself. In all cases of wounds of arteries which are the only ones rendering an operation for placing a ligature on these vessels necessary, the wound should in a great measure regulate the course of the incision. The operation is an act of simple dissection, first, through the common integuments for the space of four or five inches, then through and between the fibres of the glutæus muscle to the same extent; a dense aponeurosis covering the vessels is to be next divided, when the bleeding will lead to the injured vessel. In the dissecting-room the operation is described as follows:—Place the body on the face, turn the toes inwards; commence the incision one inch below the posterior spinous process, and one inch from the sacrum, carry it on towards the great trochanter in an oblique direction to the extent of four or five inches, divide the gluteus muscle and the aponeurosis beneath it, and seek for the artery as it escapes through the upper and anterior part of the sciatic notch and lying close to the bone. If the vessels of the gluteus muscle bleed, so as to be troublesome, and cannot be stopped by compression, they must be secured.

If the sciatic artery be the vessel injured, the incision should be made in the same direction, but about an inch and a half lower down; if the course of the wound renders it doubtful which artery is wounded, the incision should be as nearly as possible between the two lines directed, the wound being always the best guide; and care should be taken in every instance to include nothing in the ligature but the artery.

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### *Of the Operations on the Femoral Artery.*

Compression should never be made on an artery on which a ligature is about to be placed; because the pulsation is thereby suppressed, and the most important guide to the vessel is at the same time taken away. Where the artery is wounded and bleeding, compression must be had recourse to in the first instance to arrest it; and the first incisions must be made without the information which the pulsation gives as to the precise situation of the artery, although the finger may be allowed to rest on the part, underneath which the artery could be felt before the pressure was applied. The external incision should always be made longer or shorter in proportion to the depth at which the artery is situated. It should be at least one-third longer in the middle than at the upper part of the thigh; and whilst a long incision always facilitates the subsequent steps of the operation, it never does harm, unless it is out of all reasonable proportion. The centre of the incision should be if possible directly over that part of the artery on which it is intended to apply the ligature; but no inconvenience will arise from its being applied nearer its upper extremity. The patient being laid on his back, and properly supported, the knee is to be bent and turned outwards, by which the head of the femur will be rolled in the acetabulum, and the femoral artery will be more distinctly felt at the upper part lying on the psoas muscle, having the vein to the inside of it, and the anterior crural nerve about half an inch on its outside, passing between the psoas and iliacus muscles, although some branches soon approach the artery, and run down on the external part of the sheath. The relative position of the parts being duly considered, an incision is to be made directly in a line over the pulsating artery, and carried through the skin, cellular tissue, and superficial fascia, down to the deep-seated, or fascia lata of the thigh. If an absorbent gland should be in the way, it must be turned aside or removed. The arteria profunda femoris is given off about two inches below Poupart's ligament, on the back part and outside, whilst three or four small vessels spring from half an inch to an inch below it on the forepart, and one or other of these may be divided. They are the superficial epigastric, the superficial pudic, the superficial circumflex of the ilium, and probably an artery supplying the absorbent glands. If they bleed so as to be troublesome they must be secured, more particularly if the femoral artery is to be tied below them. The fascia lata is now to be divided, with that part of the fascia transversalis, which descending beneath Poupart's ligament forms the sheath of the artery, when the vessel will be exposed. In dividing this fascia and sheath, the point of the knife is always to be directed to the centre of the artery, so that if it be cut by accident it may be seen, when the only result will be the necessity for the application of a ligature above, and one below it. The artery being fully exposed, as ascertained by the pulsation being felt by the finger, it is to be separated from its cellular attachment to the sheath on each side by a blunt or silver knife; and the aneurismal needle or probe, armed with a strong single thread of dentists' silk, is to be passed under it from the inner or pubic side outwards, by which all injury to the vein from the round point of the needle or probe will be avoided. Two common knots are to be made in the usual manner, when one thread may be cut off, or the two twisted together and brought carefully out of the wound; the edges of which are then to be duly approximated and retained in that situation by sticking plaster and a moderate compress, secured in a similar manner. The knee is to be bent forward to relax the parts, and laid on the outside with a pillow underneath it.

The needle will pass more easily under the artery if the thigh is bent on the trunk; and before the knots are tied, the surgeon should ascertain that pressure on the part or artery which he has nearly surrounded by the ligature, suppresses the pulsation in the tumor below.

The operation for popliteal aneurism lower down in the thigh is to be done in the following manner:—

The surgeon having turned the knee outwards, and bent the leg inwards into the tailor's sitting position, to show the course of the sartorius muscle, should trace the artery from the groin downwards, until it appears to pass under that muscle. The external incision, four inches in length, made in the course of the artery, should pass over this point one inch, so that when the fascia lata is divided, the sartorius muscle may be seen crossing over to the inside at the lower extremity of the wound. The fascia lata is to be divided for the space of two inches of the incision upwards. The fore-finger is then to be introduced into the wound, and pressure made with it rather outwardly, when it will readily distinguish the pulsation of the artery, still included in its sheath. This is to be opened by slight and repeated touches of the knife directly over the centre of the line of the vessel, or it may be divided on the director, when the artery will be exposed. The point of the fore-finger will easily recognise it from the roundness and firmness of the feeling communicated by it as well as by its pulsation, and the end of the nail, or handle of the scalpel or blunt knife, will separate it with facility from its attachments, to such an extent as will admit the blunt point of the solid unyielding aneurism needle to be passed beneath it from the pubic side. If the point of the needle does not readily come through the cellular attachments of the artery on the outside, this part must be touched lightly with the scalpel, or rubbed with the nail until the ligature is exposed, which should then be taken hold of with the forceps, and one end drawn out, whilst the instrument with the other end is withdrawn. The operator, taking both ends of the ligature, which has been in this manner passed under the artery, between the fingers of one hand, presses upon the artery with the fore-finger of the other, so as to arrest the course of the blood in it, when if there be an aneurism below, the pulsation in it will cease. The ligature is then to be pressed upwards as far as the artery has been detached, and is to be tied with a double knot. The wound is to be dressed as in the previous case by adhesive plaster and compress, but without a bandage; and the patient is to be placed in bed, with his knee bent forward, or resting on the outside if more agreeable to him.

The operation is done in this manner on that part of the femoral artery which is not covered by muscle, and all interference with the sartorius is avoided. It is the improvement on the Hunterian operation recommended by Scarpa, and ought always to be adopted. This method obviates all discussion as to placing the ligature on the outside of the sartorius muscle, or to the fear of injuring the absorbents; and as to the saphena vein, it can always be seen, and its course traced up the thigh and avoided. After the first incision is made and completed down to the fascia lata, that part is to be divided, I have said for the length of two inches, but this must be dependent on circumstances; the object being to obtain a view of the sheath containing the artery, the opening into which after the first touch of the knife may be completed with the assistance of the director underneath it; and the artery will be less disturbed in its lateral attachments by an opening into the sheath of three quarters or an inch in length, than by one of half the extent, as it will admit of the aneurism needle being passed under it with more facility, and consequently with less disturbance to the surrounding parts. I have never had reason to believe that a free opening into the fascia of the thigh has done mischief, or even into the sheath, provided the artery has not been unnecessarily disturbed.

The warmth of the limb operated upon should be maintained by gentle friction from the toes upwards to the knee, and when left at rest it should be enveloped in flannel. The wound should not be dressed until the fourth day, the limb being kept quite quiet; the patient should move as little as possible in bed, and the part of the heel on which it rests should be examined from time to time, as it may under pressure become gangrenous.

Suppression of the secretion of urine is not uncommon during the first twenty-four hours, and will be gradually removed by the patient's taking mild diluent drinks. The constitutional irritation in all these operations is frequently great, the pulse rising in forty-eight hours from eighty-five to one hundred and twenty; and if this continues until the third day, when the fear of mortification will have subsided, it should be moderated by the abstraction of a small quantity of blood. In cases of this kind I have had occasion to bleed twice, and with the happiest effect, the pulse having fallen in consequence to its natural standard. The medicines given at the same time were saline draughts every six hours, with four drops of Battley's solution of opium. The ligatures came away on and about the fifteenth day. In many cases they remain a much longer time without inconvenience.

# LECTURE IX.

*The operations on the posterior tibial and peroneal arteries; The operations on the anterior tibial artery; The operations on the carotid artery; The operations on the arteria innominata and the subclavian artery; The operations on the axillary artery; The operations on the brachial artery; The operations on the ulnar artery; The operations on the radial artery.*

### *On the Operations on the Posterior Tibial and Peroneal Arteries.*

The posterior tibial artery may require to be tied between the ankle and the heel. In this situation its pulsation may be felt, and will be the best guide to the artery. It has the tendons of the tibialis anticus, and of the flexor digitorum communis, nearer to the malleolus than itself, and distant about a quarter of an inch; there is a vein on each side of the artery. Posterior to this is the posterior tibial nerve, and nearer the heel the tendon of the flexor longus pollicis; a little below this part the artery divides into the external and internal plantar arteries. To tie the artery near the heel, its pulsation should be felt, and an incision about two inches long made upon it, through the common integuments and superficial fascia; a strong aponeurosis will be found beneath, covering the sheath of the vessels and adhering to the tendons. This aponeurosis must be carefully opened, and then the sheath of the vessels: the artery should be tied with a single ligature. The nerve is nearer the heel.

The posterior tibial artery may be tied a couple of inches higher up in the small part of the leg, by making the incision on the tibial edge of the soleus muscle, under which it lies; but in the middle or calf of the leg, a different operation should be performed for the purpose of placing two ligatures upon it in a case of wound. The old method, and that which I have recommended, have been sufficiently contrasted in pages 35 to 38, to which I now refer. The first incision, six inches long, should be made nearer to the inner edge of the leg than to the centre, and should be carried through the gastrocnemius muscle, plantaris tendon, and soleus muscle, down to the fascia, under which the artery lies with its accompanying veins, having the posterior tibial nerve to the fibular side of it. If the incision has been made in the upper part of the calf of the leg, the peroneal artery will be exposed by it; but if the peroneal artery be the vessel injured, the incision should be made towards the fibular side of the leg; and when the surgeon divides the fascia he will find this artery covered by the fleshy fibres of the flexor longus pollicis muscle, at any distance below three inches and a half from the head of the fibula; which fibres must be divided, when the artery will be found close to the inside of the bone. Above that part the artery is under the fascia, and upon the tibialis posticus muscle. It has not an accompanying nerve. Both arteries will be readily found, by either of the incisions described, if the surgeon is acquainted with their situation.

### *On the Operations on the Anterior Tibial Artery.*

The anterior tibial artery is to be tied at that point of its course in which it may be wounded. When the operation is done for aneurism, it should be performed a short distance above the tumor, and sometimes a second operation below it will become necessary. If the aneurism should be situated so high up, and so close to the origin of the vessel, as not to admit of a ligature being applied anterior to the interosseous ligament, it may be placed on the femoral artery in the thigh, and the result awaited. If it appeared likely to succeed at first, and that the pulsation returned slowly, the artery should be tied below the tumour, because the return of pulsation would probably depend on the blood regurgitating into the vessel; or a ligature may be placed in the first instance upon the trunk of the popliteal artery above where the anterior tibial is given off, by the same operation as is recommended for the ligature of the posterior tibial, the incision being begun a little higher up.

In order to tie the anterior tibial artery near to its passage from the back to the fore part of the leg, after it passes into the interosseous space and over the interosseous ligament, and for one-third of its descent towards the instep; draw a line from the head of the fibula to the base of the great toe, which will nearly describe its course. An incision four inches in length is to be made in this line down to the fascia covering the muscles; and if the foot be bent upwards and again extended, the bellies of the tibialis anticus and extensor digitorum communis muscles will be more distinctly seen. The fascia is to be divided for the whole length of the incision between them; and they are then to be separated for the same distance by the scalpel and the finger; the artery will be found close on the interosseous ligament, between its two venæ comites.

In the middle third of the leg, the origin of the extensor proprius pollicis intervenes between the tibialis anticus and extensor communis digitorum muscles. The anterior tibial nerve, a branch of the peroneal, attaches itself to the artery a little above this middle part, and is usually found in front of it, although it is not constantly in that situation: care should always be taken to avoid it.

In the inferior part of the leg, the artery lies on the tibia, having the tendons of the extensor digitorum communis on the outside, that of the extensor proprius pollicis on the inside, by which it is overlapped, being also covered by the fascia and the integuments.

On the instep this artery runs over the astragalus, the naviculare, and the os cuneiforme internum, to the base of the metacarpal bone supporting the great toe. It here divides into two branches, one dips down between the first and second metatarsal bones, to join the terminating branch of the external plantar artery; the other passes on to the inside of the great, and the opposite sides of the first and second toes. The artery is always to be found on the fibular side of the tendon of the extensor proprius pollicis.

### *On the Operations on the Carotid Artery.*

The carotid artery may be tied in almost any part of its course, and in the following way:—The patient being seated with the shoulders supported, in such a manner that the light may fall on the neck, the head is to be bent a little forwards, to relax the muscles on the fore part. An incision is then to be made on the line of the inner edge of the sterno-cleido-mastoideus muscle, by which the integuments, the platysma myoides, and superficial cervical fascia are to be divided. The extent of this incision, in persons with long necks, may be from a line parallel with the cricoid cartilage to about half an inch of the sternal end of the clavicle: when the neck is very short, it must be begun as high up as the lower edge of the thyroid cartilage, so as to be as nearly as possible three inches in length. The sterno-cleido-mastoideus muscle is then to be drawn outwards, with any vein which may be seen attached to its under edge. The pulsation of the artery will point out its situation, and the sterno-hyoideus and sterno-thyroideus muscles being drawn and kept inwards, the omo-hyoideus will be seen crossing in the upper part of the hollow thus formed by the separation of these parts. The central tendinous portion of this muscle is attached and fixed by the deep cervical fascia, and lies immediately over the sheath of the vessels, and particularly over the jugular vein. This fascia, which is strong although thin, is to be carefully divided below the muscle, and immediately over the centre of the artery, the position of which is to be accurately ascertained by the finger. At or beneath the same spot, the sheath of the artery is to be opened; and the long thin nerve, the descendens noni, which runs upon the sheath, will at this part be seen inclining to the tracheal side of the artery. It is to be separated and drawn inwards with the muscles. If the sheath of the artery be carefully opened immediately over its centre, the jugular vein will scarcely interfere with it. But as it has been known to enlarge suddenly under the exertions or excitement of the patient, so as to overlap the artery, it has been recommended to make gentle pressure on the vessel at the upper part of the incision, and below if necessary, in order to prevent this occurrence. The aneurismal needle is then to be introduced and passed under the artery from without inwards, by which the jugular vein and the par vagum nerve will be avoided, more particularly if the sheath of the vessels has been undisturbed, save where it has been opened immediately over the artery. The point of the aneurismal needle is to be brought out close to the inside of the artery and within its sheath, by which means all danger will be avoided of injuring either the recurrent or sympathetic nerves which lie behind or to the inside of it. As to the œsophagus, thoracic duct, or thyroid artery, they are not likely to be injured by any common operator; but he should be aware, that on the left side, if he is obliged to operate low down, he may meet with greater inconvenience from the jugular vein, which is more anterior to the artery, and rather overlaps it, whilst on the right side it inclines outwards from it.

The carotid artery may be tied higher up in the following manner:—The incision in this instance should terminate a little below where the former one begins, and must of course proceed upwards for the same length of three inches, in a line extending towards the angle of the jaw. The head should be laid back to enable this to be done, and ought to be kept in that position by an assistant. The artery at this part of the neck is covered by the integuments, the platysma myoides muscle, and the fascia. After the muscle has been divided, the strong fascia must be carefully raised by the forceps and opened, and the operator will do wisely in dividing it upwards and downwards on the director. With the end of the scalpel or a blunt knife he should separate the cellular texture from the veins, which appear in this situation, and are often the source of much embarrassment. The sheath of the artery is to be opened over the centre of the vessel, and the ligature is to be passed around it as before. The descendens noni nerve runs in general on the outside of the artery in this part of the neck, and afterwards crosses over to the tracheal side. The par vagum, which lies in the angle formed posteriorly by the apposition of the carotid artery and jugular vein, and to which latter it is more particularly attached, is to be avoided on introducing the aneurismal needle; and on bringing it out on the inside, the same attention must be paid to prevent injury to the great sympathetic or any of its branches. The surgeon in both these operations should draw the ligature first a little outwards and then inwards, so as to enable him to ascertain that he has included nothing in it but the artery, which is to be tied with two knots; one end may be cut off, or both may be twisted together, and brought out of the wound opposite where the vessel has been tied. The integuments should be accurately closed by adhesive plasters, and the patient put to bed with the head bent forwards, and properly supported. He should eat as little solid food as possible until after the ligature has come away; and observe even greater precautions as to quietude than in other instances, especially if the operation has been done for a wound of a branch which cannot be exposed.

The external carotid artery may be tied by an operation conducted in a similar manner. After the first incisions have been made, and the strong cervical fascia divided, the operator must feel for the pulsating vessel, which will be found on a line parallel with the cornu of the os hyoides, below which part the common trunk usually divides into the external and internal carotids, the external being the more superficial and internal of the two at their origin. The external carotid turns with its convexity inwards; and nearly opposite but rather above the os hyoides it is crossed by the ninth or lingual nerve, the digastric and stylo-hyoid muscles, and it is below this part it should be tied. Whenever the external carotid is secured by ligature, on account of a wound of a part which cannot be reached, the ligature should be applied near to its origin, that is, immediately below where the superior thyroid artery is given off, and without fear of evil occurring from the vicinity of it or of the internal carotid.

When any of the branches of the external carotid are wounded, they ought to be tied if possible at both ends, and at the part wounded. If this cannot be done, and the hemorrhage demands it, the external carotid is the vessel on which the ligature should be placed; for by cutting off at the same time as many as possible of the anastomosing arteries, a better chance is given for the closing of the injured part of the vessel.

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### *On the Operations on the Arteria Innominata, and on the Subclavian Artery.*

The arteria innominata arises from the upper part of the arch of the aorta, generally on a line nearly parallel with the upper edge of the cartilage of the second rib, ascends obliquely towards the right side, and usually divides opposite the sterno-clavicular articulation into the right subclavian and the right carotid arteries; the last of which appears to be its continuation, although the smallest in size. The arteria innominata is about two inches in length, rarely exceeding two inches and a-half, although it is very variable both in length and situation, so much so as to sometimes render the operation of placing a ligature upon it during life impracticable. It is covered by the right vena innominata, which receives the left at a right angle, near the origin of the artery. Exterior to the vena innominata are the sterno-thyroideus and sterno-hyoideus muscles, some strong fascia covering the vein at its upper part, and the first bone of the sternum. The arteria innominata may ascend higher in the neck before it divides, in which case its pulsation will be perceptible in front of the trachea, and the subclavian artery will cross higher in the neck, which is one reason for not continuing the external incision down to the sterno-clavicular articulation in the operation on the right carotid. The subclavian artery, given off behind or a little above the articulation, proceeds outwardly for the space of one inch before it reaches the inner edge of the scalenus anticus muscle, which is about half an inch in width; so that the subclavian artery, when it clears the outer edge of the scalenus anticus muscle in a tall man, is not more than one inch and a-half or three-quarters from its origin, even to the spot at which a ligature is usually placed upon it. The first branch given off is the vertebral on the upper and back part of the artery, and distant from the carotid at the bifurcation half an inch. The thyroid axis is given off at the anterior and upper part of the artery, a quarter of an inch more outwardly, and the internal mammary often arises directly opposite from the anterior and inferior part of the artery, descending into the chest behind the junction of the first and second ribs with their cartilages. The inner edge of the scalenus anticus muscle is close to these two last vessels. The phrenic nerve crossing this muscle obliquely lies on the outside of the thyroid axis, and on the inside of the internal mammary artery; having crossed the subclavian artery at this part, it descends between it and the junction of the internal jugular and subclavian veins to the chest. Internal to this, some small branches of the great sympathetic nerve, which lies itself behind, pass over the artery; and still more internal, but distant about a quarter of an inch from the carotid artery, the par vagum crosses likewise. The only point at which the subclavian artery can be tied internal to the edge of the scalenus anticus muscle is at this point, on the inside of the par vagum, and in a space scarcely more than one quarter of an inch in width, to which the carotid will be the best guide. It appears to me that a ligature may be as readily and as safely applied around the innominata immediately below its bifurcation, as around the subclavian close to the same spot, although little reliance can be placed on success attending either operation.

From this view of the parts it will be evident, that the operation may be most advantageously done in the following manner. Raise the shoulders of the patient, and allow the head to fall backwards, by which the artery will be drawn a little from within the chest. Let an incision be made over and down to the sterno-cleido-mastoideus muscle, the sternal origin of which, and nearly the whole of the clavicular origin, should be divided on a director, carefully introduced below it, avoiding some small veins which run below and parallel with its origin. An incision is now or previously to be made two inches in length along the inner edge of the muscle, which will admit of its being raised and turned upwards and outwards. Some cellular texture being torn through, the sterno-hyoideus-muscle is brought into view, and should be divided on a director. The sterno-thyroideus is then to be cut through in a similar manner. A strong fascia and some cellular texture here cover the artery, having the nerves above mentioned running beneath it, the carotid being to the inside, the internal jugular vein to the outside. By following the carotid downwards, the finger will rest on the innominata and on the origin of the subclavian, and a ligature may be placed on either. If on the innominata, the aneurismal needle, and several kinds should be at hand, should be passed from without inwards, immediately below the bifurcation, and close to the vessel. If on the subclavian, the surgeon must recollect, that there is only about a quarter of an inch of this artery on which the ligature can be applied; this small space being bounded internally by the carotid artery, and externally by the par vagum above, and the vertebral artery below. The ligature should be applied close to the vertebral artery, the needle being passed from below upwards; the greatest care being taken to avoid the recurrent nerve, which separates from the par vagum at this part, and winds under the subclavian and carotid arteries, to be continued upwards to the larynx. If the ligature be placed on the arteria innominata, the same care must be taken to draw the par vagum outwards, and to avoid the recurrent nerve. The edges of the wound should be brought together and dressed in the usual manner; the head being bent forwards on the trunk, and maintained in that position in order to relax the parts, and admit of their being kept in apposition.

This operation ought only to be performed in cases of aneurism of the subclavian artery, in which it is presumed that the disease extends as far as the external edge of the scalenus anticus muscle, but not more inwardly. The arteria innominata has been certainly tied five, if not six, times in vain, aud in two or three other instances the attempt failed, the operator not succeeding in his object. In Dr. Mott's case the ligature came away on the fourteenth day, but the patient died from hemorrhage, the consequence of ulceration of the artery, on the twenty-sixth day after the operation. Dr. Graefe's patient also died from hemorrhage on the sixty-seventh day. It is evident from these cases, that a man may live so long after the operation as to show that he does not die from the immediate effects of it, or from any that must necessarily take place. It is therefore possible, that if the operation be often repeated it may eventually be successful.

The left subclavian artery rises perpendicularly out of the chest like the innominata, but on a plane much posterior to it, so that at the part where the vertebral artery is given off, and which is about an inch and a half from the origin of the artery, it lies nearly an inch deeper from the surface than the vessel on the opposite side. It is covered by, or is more directly connected with, the important parts which are also in the vicinity of the right subclavian. The pleura adheres to it, can scarcely avoid being torn in putting a ligature around it. The par vagum is parallel and anterior to it. The internal jugular vein and the left vena innominata lie over it. The thoracic duct and œsophagus are connected with it; and the carotid artery is in front. So that with the most careful dissection it is not a very easy matter to place a ligature upon the ascending portion of the left subclavian artery, without doing more mischief than is compatible with the life of the patient.

Aneurisms of the arch of the aorta have been sometimes known to appear so far beyond the outer edge of the scalenus anticus muscle, as to impress the surgeon with the idea that they arose from the subclavian artery, and that an operation on that vessel might be attended with success. This error is not likely however to occur in the present day; the stethoscope will always point out the existence of such an aneurism within the chest, and will therefore demonstrate the impropriety of the operation. Aneurisms of this nature are usually attended by some circumstances indicating their more internal origin, independently of the information derived from the stethoscope; but an operation should only be attempted when the case is free from doubt.

Whenever an aneurismal tumor in the neck is accompanied by any alteration of the sterno-clavicular articulation, the case is clearly one totally unfitted for any operation. The same may be said of any case of aneurismal swelling, either internal or external to it, in which the stethoscope applied on the sternum in the course of the arteria innominata, or of the arch of the aorta, indicates disease. A swelling at the root of the carotid is more likely to be an aneurism of the arch of the aorta, or of the arteria innominata, than of the carotid itself, and the stethoscope will remove all doubt.

The subclavian artery has been frequently tied above the clavicle, and *external* to the scalenus anticus muscle. It should be done in the following manner. The patient being placed horizontally on the table, in such a situation that the light may be directed into the hollow in the bottom of which the artery is to be tied, the shoulder is to be depressed, and an incision made along the edge of the clavicle, commencing one inch nearer the sternum than the clavicular edge of the sterno-cleido-mastoideus muscle, and carried outwards to the extent of three inches and a half or four inches. The platysma myoides and superficial fascia are to be divided, taking care not to injure the external jugular vein, which should be drawn to the outer side of the wound. By this incision the edges of the trapezius and sterno-cleido-mastoideus muscles will be exposed.

The object of the operation is in the first instance to reach the outer edge of the anterior scalenus muscle: this lies immediately below the outer edge of the clavicular portion of the sterno-cleido-mastoideus, and the division of a portion of this part of the muscle will greatly facilitate the subsequent steps of the operation, although it may be done without it. The artery will be found crossing over the first rib at the very edge of the attachment of the scalenus anticus to it; but a quantity of cellular substance and fascia intervene, which must be torn through before it can be exposed. This should be done with a blunt round-pointed knife, in a line parallel with the first incision, but more immediately over the outer edge of the scalenus muscle. The omo-hyoideus muscle passing obliquely across the root of the neck will be in this manner exposed, which should be clearly done, because it narrows the space in which the operation is to be performed to a small triangle, the outside and apex of which is formed by this muscle, the inside by the scalenus anticus, the base by the rib, above it the subclavian vein, and above it again, but under the clavicle, the supra-scapular artery and vein. The blunt knife working in the triangular space, will first expose one or more of the nerves of the axillary plexus, which again diminishes the space; more inwardly the scalenus anticus will be felt, and should be seen by tearing through the thin fascia which lies behind the omo-hyoideus and is connected with it. The point of the finger, assisted if necessary by the blunt knife, should be passed along the edge of the muscle until it rests on the first rib, and at the angle formed between the muscle and the rib the artery will be found and known by its pulsation. The operator should detach the artery in a slight degree from its connections with the point of the nail, and the aneurismal needle should be passed in preference from below upwards, by which the pleura will be avoided. After the ligature has been passed under the artery, the vessel should be pressed upon with the point of the finger, whilst the ligature is firmly held in the other hand, by which the circulation through the artery will be stopped, and the pulsation in the tumor and at the wrist will cease, when the ligature may be tied with a double knot; and for doing this one or two steel probes having a ring at the end of each, placed at a right angle with the shaft, will afford great assistance.

In some instances, and particularly in short-necked persons, the omo-hyoideus lies close to the clavicle, and requires to be drawn upwards and outwards from it. In others, the lowest nerve of the axillary plexus lies over the artery, and may be mistaken for it. When the veins coming from the neck are large and numerous, great care must be taken to avoid injuring them, as they frequently cause, not only much hemorrhage, but great delay. Great care must be also taken in all these operations to prevent the ingress of air into any of the veins which may by accident be opened, as its admission in quantity has occasioned sudden death, although the entrance of a few bubbles may not be so dangerous as has been supposed.

### *On the Operations on the Axillary Artery.*

The patient being firmly supported or placed in the horizontal position, the arm is to be slightly separated from the body, and an incision is to be made in the course of the axillary artery, through the integuments, superficial fascia, and great pectoral muscle, in fact through the anterior fold of the armpit. The length of the incision will depend on the part at which the artery is to be secured. It may begin however, as a general rule, near that part where the pectoral muscle first touches the deltoid. The parts divided being separated, the pectoralis minor will be seen crossing at the upper part of the wound to the coracoid process, and the artery may be felt below it, enclosed in its cellular sheath, with the nerves of the arm and its venæ comites.

At the lower edge of the pectoralis minor, the artery is crossed by the outer of the venæ comites, which passes between the external cutaneous and the external origin of the median nerve, at the spot where they separate from the plexus. The artery may be tied below this separation, or the nerves and vein may be drawn to the outside, and the artery tied above the union of the external with the internal root of the median nerve and as high as the origin of the arteria thoracica acromialis, the pectoralis minor being either raised and pushed upwards, or divided. The internal root of the median nerve is in connection with the internal cutaneous and ulnar nerves; the larger of the venæ comites is to the inside and behind, but as it ascends it receives its fellow, and with the cephalic vein forms in front of the artery the subclavian vein.

### *On the Operations on the Brachial Artery.*

The brachial artery can be traced by its pulsation from the lower edge of the teres major muscle to below the bend of the arm, where it is covered by the pronator radii teres muscle. At first it is to the ulnar side of the humerus, resting on the triceps, and slightly overlapped by the coraco-brachialis and biceps muscles. In the middle of the arm it rests on the tendon of the coraco-brachialis, is close to the bone, and lies under the lower edge of the biceps; in which situation it may always be compressed by bending the forearm, so as to cause the belly of the biceps to enlarge, when pressure made immediately below it will arrest the circulation in the brachial artery. It then crosses towards the anterior part of the arm and rests on the brachialis anticus muscle until it passes the bend of the elbow. It is accompanied by two veins, which are connected to it by a loose cellular membrane forming a sheath. The external cutaneous and median nerves lie a little to the outside of the artery at the upper third of the arm. In the middle third the median nerve lies generally in front of, but sometimes between the artery and the bone, and is on the inside at the inferior part. The internal cutaneous nerve runs parallel but superficial to the artery, the ulnar nerve nearer but posterior to it. When a ligature is to be placed on the brachial artery in the upper part of its course, the incision should be made about three inches in length, and directly on the line of the pulsating vessel, by which all mistakes will be avoided. The integuments should be divided carefully, that the internal cutaneous nerve may not be injured; the fascia is then to be cut through and the forearm bent, when the vessels and nerves will be relaxed. The artery is to be separated from its veins, one on each side; and it must be recollected that the external cutaneous and median nerves are to the radial side of the artery, the internal cutaneous and the ulnar nerves to the ulnar side of it. In the middle of the arm the median nerve lies immediately over the artery, except in cases where it passes behind it, and when it lies in front it may be mistaken for the artery, from the pulsation being communicated to it. The incision should be to the same extent of three inches, directly in the course of the artery, and the ligature should be passed from the ulnar to the radial side of the vessel, in order to avoid the possibility of including either the internal cutaneous or the ulnar nerve, and for the purpose of excluding both the veins.

### *On the Operations on the Ulnar Artery.*

The ulnar artery may be tied near the wrist, where it is most superficial. Bend the wrist, so as to make the flexor carpi ulnaris act, when the tendon will be felt internal to the styloid process of the ulna; make an incision two inches and a-half in extent along the radial edge of this tendon, dividing the fascia of the arm which covers it. The artery will be felt below the deep-seated fascia, and on dividing it will be seen with its venæ comites, the ulnar nerve being behind it, and which must be avoided in the application of a ligature. In the palm of the hand, the ulnar artery having passed over the annular ligament of the wrist, is covered by the integuments and the palmar aponeurosis. To tie the ulnar artery in the *middle third* of the arm, the surgeon should bend the wrist, and trace upwards the tendon of the flexor carpi ulnaris as far as it can be felt. At the point where it becomes indistinct an incision should be commenced and carried upwards for the space of four inches; the fascia is then to be divided for the same extent, when the flexor carpi ulnaris may readily be traced upwards by its tendon, which is on the radial side of it; this muscle may then be easily separated from the flexor sublimis, beneath the edge of which the artery will be found covered by the deep-seated fascia, having a vein on each side, and the ulnar nerve to the ulnar side of it. By this method of proceeding the artery will be readily exposed, which is not always the case by any other manner of operating, and it may be tied as high up as where it passes from under the flexors of the arm. It can only be necessary to tie the ulnar artery in the upper third of the arm in consequence of a wound; and in this situation it has been considered impracticable to do it. It may however always be done, and without much difficulty.

The brachial artery, a little below the bend of the arm, divides into the radial and ulnar arteries, the radial being the continuation of the brachial in direction, the ulnar in size. The brachial artery, at the bend of the arm, is cushioned on the brachialis internus muscle, having the tendon of the biceps on the outside, the median nerve on its inside, which is at first continued on the same side of the ulnar artery; but as that vessel inclines towards the ulna for about an inch, and then passes between the two origins of the pronator radii teres muscle, the median nerve crosses it at this part to get into the middle of the arm, and is then separated from it by the ulnar origin of the muscle. The artery continues its course, inclining outwardly, under the pronator radii teres, the flexor carpi radialis, the palmaris longus, and the flexor sublimis muscles, lying on the flexor profundus. On clearing the ulnar edge of the flexor sublimis, it is covered by the flexor carpi ulnaris; and at this part it may be tied by the preceding operation, the course of the artery having been obliquely under these muscles for the extent of two inches. To tie it in any part of this course, they must be more or less divided, and the only difficulty or danger arises from the median nerve, which lies deeper under the radial origin of the pronator teres. But the whole of the muscular fibres may be divided without injuring the nerve, by successive and careful incisions through them until the artery and nerve are exposed, and a ligature may then be applied above and below the wound in the vessel. It may be supposed by way of elucidation, that a man has received a wound from a sword through the flexor muscles, which injures also the ulnar artery, as may be presumed from its situation, and the continued and impetuous flow of blood. It shall be further supposed, that this wound is in a slanting direction from the ulna towards the radius. The surgeon may, if he thinks he can calculate the point at which the artery is injured, cut down upon it in the direction of the fibres of the intervening muscles, and even through them until he reaches the artery; but if he has erred in his calculation he must introduce a probe, and after having ascertained the line the wound has taken, he should cut if necessary across the muscular fibres in that direction until he exposes the bleeding artery, and if he is careful not to divide the median nerve, no inconvenience will arise from the operation.

If the ulnar artery is wounded near its origin, and through the radial side of the pronator teres muscle, an incision should be made through the integuments and the aponeurosis of the biceps muscle; the pronator muscle being then laid bare, it is to be drawn inwards and downwards or towards the ulna, and the dissection continued until the median nerve is exposed. The probe introduced through the original wound will lead to the artery, the pulsation of which will be felt and the bleeding seen. Where the nerve crosses the artery, the vessel will be found above to the radial side of it, and to the ulnar side below. It may be tied above without dividing a muscular fibre; but at the part where the nerve crosses and below it, some fibres of the pronator teres must be divided, and in some cases the whole of them, before the artery can be properly secured by two ligatures.

### *On the Operations on the Radial Artery.*

The radial artery may be secured by ligature with great ease in any part of its course to the wrist. At the upper third of the arm, the radial artery is covered by the junction of the supinator radii longus and pronator radii teres muscles. To expose it at this part, a line may be drawn from the middle of the bend of the arm to the thumb, which will indicate its course; or the supinator radii longus being put into action, an incision is to be made from the bend of the arm obliquely outwards along its ulnar edge, to the extent of three inches, avoiding the median vein, but dividing the integuments and the fascia. The supinator muscle is then to be gently separated from the pronator radii teres by the point of the knife or by its handle, and the artery will be felt covered by the deep-seated fascia; on the division of which, it will be seen with its venæ comites lying on some adipose membrane, and on some branches of the musculo-spiral nerve, which separate it from the tendon of the biceps, which are to be carefully avoided. The musculo-spiral nerve itself lies nearer the radius, which renders it advisable to pass the aneurismal needle from that side.

In the middle third of the fore-arm, the inner edge of the supinator radii longus marks the line of the incision, which should be to the extent of three inches. The fascia being divided, the supinator longus is to be separated from the flexor carpi radialis, and on the division of the deep fascia, the artery will be found passing with its venæ comites over the insertion of the pronator radii teres, and the radial origin of the flexor digitorum sublimis. The musculo-spiral nerve lies close to the radial side of the artery.

Near the wrist, the radial artery may be tied with great facility. Make an incision two inches and a half long on the radial side of the tendon of the flexor carpi radialis, which becomes prominent on bending the wrist; the superficial and deep fascia are to be divided, when the artery and its veins will be exposed; the nerve has not accompanied the artery to this part, where it lies, first on the flexor pollicis longus, then on the pronator quadratus, and lastly, in crossing round to the back of the hand, on the radius alone.

The radial artery, on reaching the base of the first bone of the thumb on the back of the hand, lies close to it and under the three extensor tendons of the thumb. It then dips down between the first bone of it and the metacarpal bone of the fore-finger, and enters into the palm of the hand, to form the deep-seated palmar arch; sometimes passing behind the abductor indicis and adductor pollicis muscles, sometimes perforating them. The treatment of wounded arteries in the hand is described in the 7th lecture.

THE END.

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# ON

# WOUNDS AND INJURIES

# OF THE

# ABDOMEN AND THE PELVIS;

BEING THE

SECOND PART

OF THE

LECTURES ON SOME OF THE MORE IMPORTANT POINTS
IN SURGERY.

By G. J. GUTHRIE, F.R.S.

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On concluding my Lectures "On Some of the more Important Points in Surgery," in July last, I promised to recommence them in November, in order to leave a record of the practice pursued in the Treatment of Wounds and Injuries of the Chest, the Abdomen, and the Pelvis, during the Peninsular War. Rendered unequal to the performance of this promise, by the greatest calamity which could possibly have befallen me, I have drawn some consolation from beguiling away my winter evenings in preparing a part of them for the press, with the hope and the belief that they may be useful, not only by pointing out what has been done to the present time, but by drawing attention to what ought perhaps hereafter to be done under similar circumstances.

4, Berkeley Street, Berkeley Square.
10th March, 1847.

# LECTURES

ON SOME OF THE MORE

# IMPORTANT POINTS IN SURGERY.

## PART II.

## ON WOUNDS AND INJURIES OF THE ABDOMEN.

### LECTURE I.

*Three kinds of wounds and injuries of the abdomen; The formation of ventral hernia, the sequence of bruises, and wounds of the abdominal parietes; Case of severe bruise of the abdominal parietes in the left iliac region, by a piece of shell, followed by ventral hernia; Case of ditto, from a blow with the end of the spanker-boom; No rupture of the muscular fibres distinguishable in these cases, and their absorption, a process subsequent to the injury; Abscesses in the abdominal parietes; The strength of the fibrous structure of the peritoneum the cause of their not bursting into the abdominal cavity; Case of psoas abscess, the matter ascending from Poupart's ligament, and burrowing between the peritoneum and abdominal muscles; Case of extensive musket-ball wound of the muscular parietes of the abdomen, with exposure of the peritoneum, healing by granulation; Distinction between the orifice of entrance, and that of exit, of a musket-ball wound; Oblique musket-ball wounds of the abdominal parietes; Coursing of the ball under the skin; Lodgment of a musket-ball deeply in the wall of the abdomen; Formation of a sac of dense cellular membrane around a ball, when retained* in situ *a long period of time; Stabs of the wall of the abdomen; Their reputed danger, dependent on the occurrence of suppuration, or the retention of the pus between the muscles, or in or under their aponeurotic sheaths; Prevention of suppuration by enlargement of the wound; Treatment of stabs of the abdominal parietes; Case of sabre wound of the abdominal parietes and stomach, followed by a small hernia of that organ; Rupture of the internal organs of the abdomen from external injury; Case of rupture of the liver from a fall from a horse; Case of rupture of the small intestines from a horse's kick; Comments on the treatment; Case of rupture of the small intestine, from a blow with the wadding of one of the park guns; Case of rupture of the small intestine, from a fall on a man's thumb; The first effect of ruptured intestine the extravasation of the contained gas; Abdominal swelling and tension a distinguishing symptom of ruptured intestine; Jobert de Lamballe's case of ruptured intestine from external violence—recovery; death from hæmoptysis; Symptoms of rupture of the fixed viscera; Death generally occurs from hæmorrhage; Case of rupture of the kidney from a cannon-shot; Case of injury of the abdomen from a cannon-shot, followed by fatal peritonitis; Baron Larrey's cases; Necessity for a well-directed medical, as well as surgical, treatment of all these injuries; Imperfect union of the muscular parietes of the abdomen after an incised wound; Ventral hernia following the operations for ligature of the common or external iliac; Question as to the propriety of employing sutures through the muscular parts in wounds of the abdomen; Opinions of Chelius, South, Von Graefe, and Weber, on the application of ligatures in treating these wounds; Evils of the practice of employing ligatures; Recommendation to use the continuous suture, passed through the skin and cellular tissue only; Advantages of the practice; Additional support to be afforded by strips of adhesive plaster, and not by a bandage; Position of the patient to be such, that the opposed surfaces of the peritoneum may unite together by the adhesive process; Excess of inflammation causes great secretion of serum, and shreds of lymph; Absolute quietude to be observed; Purging equally injurious in such cases, as after the operation for strangulated hernia; When a stool is passed, any unnecessary action of the abdominal muscles must be prevented; The* *practice of bleeding immediately on the receipt of a stab, condemned; not to be employed until after reaction has taken place, and then according to the symptoms; The application of leeches; Symptoms requiring the loss of blood; The operations for the removal of ovarian tumours; Wounds of the linea alba can unite so as to resist a hernial protrusion; Large openings may be made through it into the abdomen with impunity; The results of Dr. F. Bird's operations for ovarian tumours; Penetrating wounds of the abdomen, without injury to the viscera, when properly treated, not so dangerous as generally supposed; Penetrating wounds of the belly, with injury to the contained viscera; Mr. Green's case of penetrating wound by an iron spike, with laceration of the right common iliac vein; Case of penetrating wound by a ramrod; M. Besson's case of penetrating wound by an iron spindle; M. Scarutti's case of wound of the thigh and abdomen, by falling on a stake; Penetrating musket-shot wounds of the abdomen; Usually followed by protrusion of omentum or intestine; Treatment of the omentum, when protruded; Treatment of omentum, when external to the abdomen, the opening in the latter being too small for its restoration to its proper cavity; Enlargement of the wound in the skin and muscles requisite, but not of that in the peritoneum; Small wounds of the peritoneum not dangerous, when properly covered by the neighbouring healthy parts; Large ones followed by disastrous consequences; Case of penetrating wound of the abdomen, with protrusion of the omentum; Baron Larrey on the treatment of protruded omentum; Case of lance-wound of the abdomen, with protrusion of the omentum; Case of penetrating wound, with protrusion of the omentum, requiring enlargement of the wound in the skin and aponeurotic expansion; Case of musket-shot wound of the abdomen, with considerable protrusion of omentum; M. H. Larrey's case of penetrating wound of the abdomen, with protrusion of omentum; Dr. Hargrave's case of penetrating wound, with protruding omentum, the latter being removed by ligature; Mode of returning protruded omentum, intestine, or mesentery; Treatment of torn, jagged, suppurating, or gangrenous omentum; Intestine, when protruded, without having been wounded, to be returned in all cases, unless mortified; Disapproval of the directions, usually given to reduce protruded intestine; Adhesion between the wounded peritoneum and the intestine which has been protruded, should be obtained; Cases of penetrating wound, with protrusion of intestine; Protrusion of wounded intestine; A mere puncture, or small stab, of no consequence; Case of wounded and protruded intestine; Correct prognosis in cases of wounded intestine, almost impossible; Littre's case of recovery after severe wounds of the liver and intestine; The probability of the effusion of the contents of a wounded intestine, dependent on the size of the wound; The consequences of the effusion, when large or small; Large effusion of blood from rupture of the liver or spleen; Small effusions may be confined to one spot, and removed by absorption, or discharged externally, or by the bowels; Cases of penetrating wound of the abdomen, followed by circumscribed abscess, or by general formation of matter.*

Gentlemen,—Wounds and injuries of the abdomen are essentially of three kinds:—1. Affecting the paries, or wall. 2. Opening or extending into its cavity. 3. Wounding or injuring its contents.

The wall of the belly, in consequence of its being principally composed of three layers of muscles, more or less tendinous, extending from the lateral parts towards the front, and by their aponeurotic or tendinous expansions over it, is when severely hurt, liable to a permanent defect which has not been so especially alluded to as it deserves, as the ordinary result of a severe bruise, excepting in cases where the muscular fibres have been ruptured. It is the formation of a ventral rupture. A division of the wall to any extent, by a sharp cutting instrument, is usually followed by a similar consequence; and it never fails to occur in the openings made by a musket-ball penetrating into, or passing through the cavity.

Case 1.—Captain Tarleton, of the 7th, or Royal Fusiliers, was struck on the left iliac region, by a large flat piece of a shell, at the Battle of Albuhera, in 1811. The surface was not abraded, although the iron caused a very severe and painful bruise; the whole of that side of the belly becoming quite black, and the remaining part much discoloured. This gentleman, who subsequently suffered but little, recovered under an ordinary, and perhaps careless treatment. Some months afterwards, he drew my attention to the part, and I then found that the whole of the muscular portion of the wall had been removed by absorption, to the extent of the immediate injury from the piece of shell, the tendinous parts alone remaining under the integuments. These appeared to be much thinner than usual, and protruded on any effort, constituting a circular-shaped ventral rupture, with a large base, and requiring the application of a pad and bandage for its repression.

Case 2.—Mr. Smith, a deputy-purveyor, while disembarking stores from a small vessel in the Tagus, received a blow on the side of the fore-part of the belly, from the end of the spanker-boom, which, in swinging round, knocked him down, and gave rise for some time to much inconvenience. He shewed the part to me in Lisbon, in 1813, in consequence of the formation of a ventral hernia, to the extent of the spot originally injured. In neither of these cases was such a result expected; no rupture of the fibres of the muscles was distinguished at the time; and it was supposed that the sufferers would recover, without any permanent defect. The absorption of the muscular fibres was, therefore, a subsequent process; and whether this result may or may not be prevented in similar cases, by a more active or a longer-continued treatment, with the early application of a retaining bandage, is to be ascertained. It may be that some muscular fibres were actually ruptured, and others bruised, in these cases; but the extent of the absorption was in the end much greater than the apparent injury in the first instance, would seem to have warranted under any circumstances.

Abscesses form from neglected injuries of this kind, and give rise to the most serious apprehensions of their bursting into the cavity of the abdomen, which, however, they have not done in any cases I have seen, and very rarely do, I believe in any case. The safety of the peritoneum, and its capability of affording sufficient resistance to the progress of the matter through it, seem to depend upon the strength of the fibrous structure on its outer or muscular side; the inner or really serous surface being very delicate, and offering but little resistance to the application of any moderate degree of force.

Case 3.—I saw, when in British North America, in 1805, a psoas abscess, which had descended as far as Poupart's ligament, when the matter it contained passed upwards between the peritoneum and the muscular wall of the belly, and gave rise to an external collection of matter. The patient ultimately died from general irritation, the matter finding its way into the bladder, but not into the cavity of the abdomen, the strength of the peritoneum having been its safeguard.

Case 4.—Lieutenant Colonel Grey, of the 5th Regiment, now a Major General in India, was wounded at the assault of Ciudad Rodrigo, in 1812, by a musket ball, on the left side and forepart of the abdomen near the crest of the ilium; it made a wound about four inches in length, cutting away the muscles of the abdominal wall so deeply as to lead to the exposure, and as I feared, to the ulceration of the peritoneum, when the sloughs should separate. It did however no such thing; granulations, on the contrary, sprang up from the bottom and sides of the wound, which gradually closed in, and healed without further difficulty. I have seen the same thing occur in so many instances, as to leave no doubt of the great, and generally effective resistance the peritoneum is enabled to make against the ulcerative process, when in its immediate vicinity.

It has been supposed, theoretically, to be a matter of importance to discriminate between the orifice of entrance of a ball passing through the abdomen or its wall, and that of its exit. I believe it to be practically a matter of indifference, although the part on which the ball impinges is usually distinguished by a more circular and depressed appearance, whilst the opening of exit more frequently resembles a tear or slit, the edges of which are rather disposed to protrude.

A ball striking obliquely against the wall of the abdomen, has been said to run sometimes nearly round under the skin, or between the muscles and the peritoneum, proceedings upon the recurrence of which, little expectation need be placed. It may, however, do something of the kind for a considerable distance, passing even over, or between the spinous processes of the vertebræ behind. In such cases, when they actually occur, the course of the ball will usually be marked by a line on the skin, more or less of a reddish blue colour; and the constitutional alarm, if it should occur at all, will subside early. A ball may, however, pass under and between the muscular layers of the wall of the belly, (or run for several inches nearer to the peritoneum,) giving rise to great anxiety, until the sloughs have separated from the openings of entrance and of exit, at which parts they prevail to a greater extent, than in the middle of the track of the projectile. In some few instances an opening will require to be made in the middle of this track or course of the ball for the evacuation of pus, or of other extraneous matters which may have been detained in it.

When a ball lodges in the wall of the abdomen, and is deeply situated, it sometimes escapes notice, and when found, is often better let alone, unless it prove troublesome. When it approaches the surface, it may be removed if it cause inconvenience. When removed after the lapse of twenty or more years, I have always found some dense cellular membrane forming a sac around and adhering to the ball, which is usually more or less flattened and irregular.

Injuries of the wall of the abdomen, from cuts or stabs affecting the muscular and tendinous parts, are said to be frequently troublesome, and even dangerous, from their giving rise to pain, vomiting, and severe general derangement. This only occurs when suppuration takes place, and from some accidental circumstance the matter does not find a ready exit, but collects between the muscles, or within or under their aponeurotic sheaths. This is indicated by the pain and swelling of the part proceeding sometimes to the formation of an abscess, which ought to be prevented, if possible, by an early enlargement of the wound, so as to remove the cause of irritation and the obstacle to the free discharge of the secreted matter. If the swelling should become prominent in a more convenient situation than the spot of injury, it should be opened at that part.

In these and in all other serious injuries of the abdomen, the recumbent position with a relaxed state of the muscles, should be observed for several days at least. The antiphlogistic plan of treatment should be fully enforced, especially by leeching, bleeding, and spare diet, and in due time the part should be supported by a proper bandage.

Case 5.—The late General Sir John Elley was wounded in the last charge of heavy cavalry at Waterloo, by the point of a sabre, which entered nearer the extremity of the ensiform cartilage than the umbilicus, causing a wound about two inches in length, penetrating the stomach. From this he recovered in due time without any severe symptoms, but with a small hernia of that organ, which remained until his death, giving rise occasionally to some gastric inconvenience, when he did not keep a gentle pressure upon it by a retaining bandage.

Severe blows, or contusions from falls, or from the concussion of foreign bodies, may give rise, not only to injury of the internal parts of the abdomen, followed by inflammation—but to rupture of the hollow as well as of the more solid and fixed viscera, and death.

Case 6.—A soldier, in the 13th Lt. Dragoons, was thrown over his horse's head, in 1805, at Sandwich, in Kent, on a field-day, in consequence of the horse having had his foot caught in a rabbit-hole. He complained only of the shock he had received, not of any particular blow or injury, and declared he should soon be well again. He however gradually sank, and died without a groan. On examination after death, a large quantity of blood was found extravasated in the cavity of the abdomen, the liver whence it came having been ruptured in two places.

Case 7.—William Fletcher, 18th Hussars, a healthy man, 37 years of age, received a kick from a horse, immediately above the os pubis, on the 15th of April, 1810 (about a league from Cartaxo, on the Tagus); great tension of the belly soon followed, with excessive pain and vomiting. The pulse rose rapidly. He was bled to syncope twice during the day, to the extent of ℥xvi. each time. In the evening he was removed to Cartaxo, and taken into hospital; the pain continued, accompanied by retching, without much vomiting; the abdomen was constantly fomented with hot water; an injection was thrown up, and two ounces of infusion of senna with salts were given every two hours.

16th, Horâ 6 A.M.—There is less tension of the abdomen, and not so much pain; bowels not open; pulse quiet; has not vomited for four hours; made water freely three times during the night. Cont. mist. laxativa omni horâ, donec alvus soluta erit.

Horâ meridie: passed a small, slimy stool; pulse increasing rapidly. Mitte sang. e brachio ad ℥xvi. Rept. inject.; sumat ol. ricini ℥ss. statim.

Horâ 4 P.M.—Has gone to stool three times, but with little effect; considerable tension, and pain of the abdomen on pressure; pulse small, frequent, and irregular; has vomited several times during the day.—Rept. inject.; cont. fotus.

Horâ 10 P.M.—The stomach has become more irritable; rejects every thing; pain and tension of the abdomen increased; pulse sinking; remained perfectly sensible, and, at 3 o'clock A.M., expired.

*Appearances on Dissection.*—The peritoneum contained a very large collection of fluid, of a very offensive fœtor, slightly tinged with bile, and partaking of a fæcal nature, but was less inflamed than the omentum or mesentery; the bowels themselves appeared to have suffered to the greatest extent; and, on accurately examining the small intestines, a laceration was discovered in the ileum, which doubtlessly was the cause of death.

(Signed) W. Chambers, Surgeon.

The purgatives in this case did no good, if they did not do mischief. The tension, or tympanitic state of the abdomen, was well and early marked in this, as in the two succeeding cases, and may be considered to be almost pathognomonic of laceration.

Case 8.—A boy was brought to me at the Westminster Hospital, many years ago, in consequence of having fallen from a tree, in which he had seated himself to see the guns fired in the Park, the wadding of one of them having struck him in the belly. The parietes were uninjured, and hardly discoloured. The shock was considerable, and re-action was followed by swelling and tension of the abdomen, with pain, and other symptoms of inflammation, which terminated in death. On the examination of the body, the small intestine was found to have been ruptured by the blow, and considerable extravasation had taken place into the general cavity of the abdomen.

Case 9.—A child, just able to walk, was placed under my care, in the Westminster Hospital, in consequence of its having received some injury on the side of the belly, from having been tossed up into the air by its father, with his right hand, and caught in its descent in the crutch, formed by the thumb and fingers of the left, on the thumb of which it unfortunately at last fell; this caused the child great pain, which was soon followed by considerable swelling and inflammation of the belly, of which it died. On examination after death, the small intestine was discovered to have been ruptured by the end of the thumb, from which extravasation of its contents into the abdomen had ensued.

The first effect of a rupture of the intestine must be the extravasation of such gas as may be contained in, or secreted from it, giving rise to the sudden swelling, as well as to the sudden effusion of part of its contents, but which, from the support of continuity, and of the general pressure of the abdominal parietes, is, perhaps, more gradually poured out. M. Jobert de Lamballe, in his *Traité Theorique et Pratique des Maladies Chirurgicales du Canal Intestinal*, considers the rapid tension and swelling of the belly to be a distinguishing symptom of rupture of the intestine; and he relates a very interesting case in point, which Messrs Paillard and Marx, in editing the Clinical Lectures of the Baron Dupuytren, have thought it right to reproduce at page 416 of their work.

Case 10.—N———, 22 years of age, was knocked down by a carriage, one wheel of which went over his abdomen, without injuring the external parts. Carried immediately to the Hospital St. Louis, the belly was found to be distended, stretched, and sounding like a drum when struck, with scarcely any uneasiness. He was bled and leeched several times in succession, strictly dieted and treated, and had nearly recovered, when he was seized with hemoptysis, of which he died after being two months in the hospital. The small intestine was found adhering to the omentum, and with it to the peritoneum lining the last of the false ribs. On carefully examining the inside of the intestine, a sort of projection was seen in its cavity, which proved to be the omentum, which had passed through a rupture of the bowel to the extent of about the third of an inch. The plug and the adhesion thus formed did not take place sufficiently early to prevent the effusion of air from the bowel, although time enough to prevent the extravasation of its contents. The recovery although purely accidental, is nevertheless, highly deserving of remembrance, as shewing the propriety of never abandoning a patient for an instant, however bad may be the symptoms, or the prognosis.

Case 11. A Spanish soldier was brought to me, near the conclusion of the battle of Toulouse, in consequence of having been struck obliquely by a cannon-shot on the right side of the abdomen and back, which appeared to be badly bruised, although no abrasion of the skin had taken place. The shock was however great; he was unable to move his limbs, and appeared likely to die, which he did in fact do in the course of the night, having passed bloody urine, but without any reaction having taken place. On making an incision through the skin, which was then quite a blue-black, although not torn, all the soft parts were found reduced to a state approaching to the appearance of jelly: the spine was injured, the right kidney ruptured, and the cavity of the abdomen full of blood.

Case 12. A soldier of the 40th regiment, was struck by a ricochet cannon-shot, on the last day of the siege of Ciudad Rodrigo. He saw the ball, which destroyed his left fore-arm, so as to render amputation necessary, strike the ground a little distance from him, before he was himself injured. He thought from the sort of shock he had received, that it had also struck his belly; but this I should not have credited, if it had not been for a bruise across the umbilical region, without actual abrasion of the integuments, on which account my attention was drawn to him on the fourth day after the injury, at the hospital of Aldea Gallega. He had been bled in consequence of complaining of pain, and from the quickness of pulse and fever which had ensued, and which were attributed to irritation after amputation. The belly was swelled and tender under pressure. Calomel, antimony, and opium, were given; he was bled again, and blisters were applied; the stump took on unhealthy action, and he died a fortnight after the receipt of the injury. The abdomen, when opened, was found to contain a quantity of opaque serous fluid, mixed with shreds of coagulable lymph. The omentum and intestines were of a dark colour, and loaded with blood; distinctly indicating the chronic state of inflammation which had taken place. Baron Larrey has related in the third volume of his Campaigns and Memoirs, three cases of a similar nature. The first two died; one from effusion and fever, on the fifteenth day. In the second, a ricochet shot, at its second or third bound, had grazed the skin of the abdomen. He suffered little at the moment; but the injury was sufficient to give rise, after several weeks, to effusion into the cavity, when the Baron evacuated by a trocar, a quantity of bloody fluid, which deposited after standing a little time, a quantity of fibrine. Thinking, from the feel of the part, that some coagulated blood remained behind, he enlarged the opening in the abdomen, and thereby allowed a large quantity of coagulated blood, &c., to escape. There were for a time great hopes of a cure, but this passed away; he became dropsical, was tapped several times, and in all probability died. The third case recovered, without effusion or any immediate mischief, although he was invalided as unfit for further service.

These peculiar instances shew the strict attention which ought to be paid to all such cases, until every trace of mischief has been removed, and demonstrate the necessity of a well-directed medical, as well as surgical treatment of all these injuries.

When the fixed viscera are ruptured by severe blows, such as those received by falls or from cannon-shot, the symptoms are not only those of inflammation of the peritoneum, if the patient should survive long enough; but of the organ itself, and of lesion of the function it performs. The sufferers usually however die from hemorrhage, and not from inflammation, as they do not live long enough to allow of its effective formation.

When an incised wound is made through the wall of the abdomen to any extent, except perhaps in the linea alba, the muscular parts are rarely found to unite in a more perfect manner than when they are ruptured and bruised. The observations I had made on this subject during the war, were confirmed by those cases in which I have tied the common iliac or the external iliac artery, by an incision on the face of the lateral part of the abdomen, the patients recovering afterwards;

the incision through the muscular wall did not remain united, although union appeared to have taken place in the first instance, and a herniary protrusion formed in all, in the course of the greater part of the line of the wound.

The almost constant occurrence of this non-union of the divided intermingled muscular and tendinous parts constituting the wall of the belly, except by cellular membrane, led me to doubt the propriety of introducing ligatures through these parts; for the purpose of keeping them in apposition, when such object, even when at first accomplished, did not lead to the permanent cohesion of the parts, whilst it exposed the sufferers to all the dangers which the irritation of sutures commonly occasions.

Chelius, Section 513, of the translation by Mr. South, who jointly are the latest authors and commentators on this part of European surgery, approves of the practice of sewing the divided muscles together. Chelius recommends "several flat ligatures, to be introduced through the skin and muscles, the needle being placed close to the muscular surface of the peritoneum." Graëfe, Section 514, is declared to be of the same opinion, he recommending, however, that a soft tape should be substituted for a ligature. Reference is made to Weber in support of this practice, to which Mr. South does not raise any objection. Chelius is, however, perfectly aware of the evils which may result from it, and says, "If after union of the wound of the belly with stitches, vomiting and hiccough occur, if the wound inflame smartly, and these symptoms do not yield to the antiphlogistic treatment, and to the use of opium, the threads must be loosened or entirely removed, and the wound merely held together with sticking-plaster and bandage." The danger thus incurred appears to me to be best obviated by refraining altogether from the introduction of ligatures through the muscular and tendinous parts of the wall, more particularly as it does not appear that permanent cohesion is generally effected by them, and the advantages which may be supposed to be derived from the greater degree of apposition occasioned by the ligatures, are more than counterbalanced by the evils which the traction on muscular fibre occasions. No London surgeon in the present days stitches the divided ends of muscles together except in the abdominal parietes, when the peritoneum is also divided, and the sooner the practice is abolished in that part—in wounds of moderate extent—the better it is my belief it will be for the sufferers.

The practice I have recommended in my lectures for the last thirty years, in all simple wounds of the wall of the belly of moderate extent, is to bring the edges of the wound together, by means of a small needle and a fine silk thread passed through the skin, and the loose cellular membrane only, which is in contact with it, by a continuous suture without puckering, precisely in the manner a tailor would fine-draw a hole in a coat, or a lady a cut in a cambric pocket-handkerchief. This gives a certain degree of support to the parts beneath, and if proper attention be paid to maintaining a well-regulated relaxed position of the muscles, no great separation takes place in wounds of a reasonable extent, and little or none in a wound of smaller dimensions. An effective support should be also given by strips of adhesive plaster extending to some distance around the body; a bandage rarely does good, and will assuredly do mischief, unless it be very carefully applied and watched, so as only to give support, and not to make undue pressure. The position of the patient is of the greatest importance; its essential object is to bring the edges of the incision, and especially of that in the peritoneum, as nearly as possible in apposition, so that the space between them may be more easily filled up by the opposing peritoneum forming the anterior layer of the omentum, or by the outer covering of the intestine, if the omentum should not intervene. This is to be effected by the gentlest inclination of the body towards the wound, which may be supposed capable of keeping these parts in apposition; for although the omentum and intestines are often capable of undergoing a considerable degree of motion from side to side, independently of that peculiar worm-like movement on themselves which in the intestines is called peristaltic, they very frequently do not wander from place to place, in the manner which has been sometimes attributed to them, but remain under proper care, so far stationary, as to admit of the cut edges of the wounded peritoneum, adhering to the healthy peritoneum opposed, and are thus retained in contact with it. The serous surfaces of the peritoneum which are in contact with each other soon offer on one part and accept on the other, the process of adhesion, through the medium of lymph or fibrine deposited between them; and if this adhesion take place, it extends for some little distance from the wounded part, which it thus closes up, and cuts off from all communication with the general cavity of the belly; the previous admission of air —the bugbear of the olden time—having been of no sort of consequence. The adhesive process is the effect of inflammation, extending to a certain point, and ending in the deposition of fibrine. When it exceeds this, the secretion of a quantity of serous fluid, together with threads of flocculent matter mark the excess of inflammation, and are diffused over more or less of the peritoneum lining the wall of the belly, covering its contained viscera, and preventing that adhesion from taking place which is the safeguard of the patient.

Absolute quietude is no less to be observed. It must however be steadfastly continued; the slightest alteration of position should be forbidden. It should on no account, and for no reason whatever be allowed, if it can by any possibility be avoided. In the position in which the patient is placed, he should be rigorously maintained, until adhesion has been effected, or all hope of it has passed away. When I first became an Examiner of the College of Surgeons, I found the practice of the older surgeons was to purge such persons vigorously, in order to remove from their bowels any peccant matters which might be in them; in the same manner that they recommended persons should be purged, who had undergone the operation for strangulated hernia—both which practices are now sufficiently condemned and reprobated, as being not only contrary to the right medical treatment of such cases, but to the physiological and surgical principles on which it ought to be founded. No purgative medicine whatever should be given to a person with a penetrating wound of the abdomen. No food should enter his mouth; and no more water even should be allowed than may be found requisite to moisten the lips, and allay any intolerable thirst which may ensue. This precaution need not be carried out so strictly, if it could be readily ascertained that an intestine was not wounded; but as this knowledge, however satisfactory it would be, cannot always be obtained, and ought not in the generality of instances to be sought for, the restriction should be fully observed, if possible. In all cases of injury of the belly, there is more or less of shock, alarm, and anxiety. It is sometimes remarkably great, even when the mischief has not been considerable. When little or no injury has been inflicted on the intestine, the natural and usual action of expelling the contents is generally delayed beyond the time at which in health, it would in all probability, have occurred. When nature shall point out, by the sensations of the patient, an inclination to perform this function, it may be assisted by an injection of warm water, or of any mild laxative which may facilitate the process, and prevent any unnecessary action of the abdominal muscles, against which the patient should be cautioned. The attendants should be forewarned that the position of the patient is not to be interfered with, under any circumstances; the necessary arrangements being made by bedsteads of a proper construction, or by other simple means, which are sufficiently well known.

The custom of directing a man to be bled forthwith, as well as purged, because he had been stabbed, was another error much in esteem with my older colleagues, but which experience did not sanction, and which I could not, therefore, approve. The abstraction of blood before reaction has taken place, after the constitution has sustained a severe shock, delays its occurrence, as well as the commencement of that inflammatory stage, which is to be so salutary in its result in favorable cases. It tends to prevent the agglutinative process from taking place, and thus aids the diffusion of inflammation over the whole surface of the peritoneum. The general abstraction of blood is to be ordered, and regulated as to quantity by the increasing signs of reaction, and by the augmenting intensity of the symptoms of inflammation which may accompany or follow it. The quantity of blood required to be taken away in these cases is usually large, in many cases very large, particularly at an early period. It is however, often a nice point to determine when blood enough has been abstracted with advantage; and I am satisfied I have seen many cases in which too much has been taken away, as well as too little; the former being marked after death by the general diffusion of a slight degree of inflammation, without the concomitant signs of effusion of serum, and of flocculent and even almost purulent matter, indicating a severity proportioned to the symptoms and to the result. Leeches, applied in considerable number, will often be found highly beneficial, more particularly at a late period, when it is doubtful whether the sufferer will bear such a general abstraction of blood as may be necessary to give relief. The patient, after leeches have been once applied, and their good effect has been ascertained, will often himself on the recurrence of pain, or on its increase, ask for them, and I have often applied from twenty to sixty, eighty, and even a hundred, with the greatest advantage, but they are not always to be procured.

Those who have been well instructed in the treatment of disease—and what surgeon should not be so instructed?—know that the pulse is by no means a guide in the management of these cases; a small, low, and sometimes not even a hard pulse, being more strongly indicative of an overpowering state of inflammation than a quick and full pulse, and that much more depends on the pain, and the anxiety, and the general oppression, than on the apparent state of the circulation. Before general and local bleeding cease to be employed with advantage, calomel, antimony, and opium will render essential, nay, most important service.

The operations which have been performed of late years for the removal of ovarian tumors, and in which incisions of great length have been successfully made in several instances, in the linea alba, have attracted particular attention. The trifling consequences which generally follow the common operation of tapping the belly in dropsy, and which no one thinks any thing of when done in the linea alba, would seem to imply that this tendinous part may be divided with much less danger than others. That a wound in the linea alba can unite, so as to form a firm adhesion, capable of resisting a protrusion, or the formation of a hernia, cannot be doubted. Mr. Walne was so good as to send me a woman for examination, whose abdomen he had incised to the extent of fourteen inches, for the removal of an enlarged ovary; and at the expiration of as many months, there was no sign of protrusion, the parts which had been divided seeming to be well and firmly united. In other cases, he says, a hernial protrusion has taken place, where the parts did not unite by adhesion, in consequence of the passing through of a ligature, which had been placed on the peduncle of the ovarian tumour. He also found, after death, the peritoneum completely united, without attachment to any viscus, so that it required close inspection and comparison of situation with the external wound, to ascertain exactly the part where it had been divided.

Dr. F. Bird informs me that in twelve of the cases he has recently examined, in which he opened the abdomen for the removal of ovarian tumours, the incision, in five, did not exceed three inches in length, in five, it extended to four and a half, or five inches; in one to eight inches; and in one, to rather less than twelve inches. The incisions were made in the linea alba, and without division of muscular fibre, save in one case, in which it was necessary to make an oblique incision on the left of the umbilicus, dividing transversely, or nearly so, the outer edge of the rectus, and internal portion of the obliquus externus muscles.

Remarkable contraction of the distended abdominal walls generally took place, soon after the wounds had healed, and in the majority of instances to so great an extent, that incisions of five inches became replaced by cicatrixes scarcely more than an inch long. Whenever such complete contraction occurred, no tendency to hernial protrusion was subsequently observed; whilst in two patients, in whom the incisions were respectively eight and twelve inches long, the abdominal walls became but little contracted, and there resulted in one a marked protrusion of the cicatrix, and in the other a manifest hernia, for which artificial support has lately been required. In this last case the wound did not close by adhesion, but slowly healed by granulation.

In an instance in which a small incision was made transversely to the course of the muscles divided, hernia very quickly followed.

The method of closing the wound was in all cases the same, that of introducing two interrupted sutures in every inch of incision, the skin alone being included.

If it should be proved that incisions may be made with more confidence of success than hitherto has been supposed, and as these sections may lead us to believe, it will only confirm what I have constantly repeated from year to year in my lectures, that penetrating wounds of the abdomen, without injury of the viscera, when properly treated, are not so dangerous as they were generally supposed to be. In the sections made by other surgeons for the removal of diseased ovaries, ligatures have been sometimes used for the purpose of bringing the divided muscular and tendinous parts together, and although I forbid their employment as a general rule, I do not wish to imply that in very extensive transverse wounds they can be entirely dispensed with, if only to prevent the immediate protrusions which the suture through the skin might not be equal to resist in every case.

In penetrating wounds of the belly, the offending instrument frequently passes in for a considerable distance, sometimes separating or pushing the viscera aside without injuring them, at others inflicting upon them wounds more or less severe; and in those cases of stabs from knives and sharp instruments, which are fatal, I suspect that the intestines have been injured by the point; although after the lapse of three or four days before death takes place, the small wound is not readily perceived. I have seen this in several cases, which ultimately proved fatal.

Mr. South in his annotations on Chelius, page 458, vol. 1, relates the history of a case under Mr. Green, in which two iron spikes penetrated the abdomen, the patient having fallen from a height of twenty-six feet. One, which entered just above the navel, was broken off, and was found after death in the abdomen, having deeply indented the third lumbar vertebra, and torn the right common iliac vein. It passed between the loose viscera without having injured any of them. The omentum, on the third day, or that of his death, was found adhering to the external wound.

Case 13. W. Carpenter, private, 1st. battallion, 43rd regiment, was accidentally wounded, March 19th, A. M. 1812, by his comrade, the small end of a ramrod entering about two inches below the navel, passing in a direction upwards, penetrating the second lumbar vertebra, and protruding an inch and a half on the opposite side.

The soldier was carried from the trenches, the distance of a mile, on a bearer, the ramrod supported by one of his comrades.

On examining the wound, I found the ramrod firmly fixed in the bone. I endeavoured, at first, to extract it by a gentle turn, making extension at the same time; but in this I failed. I was then induced to use force on the opposite side, by fixing the broad end of a ramrod on the point of the protruded one, my assistant, Mr. Williams, making simultaneously the same amount of extension, that I in the first instance had attempted, but was again mortified at finding I gained nothing by the procedure. Finding myself baffled in these attempts, I conceived that I might perhaps succeed, by again fixing the broad end of the ramrod on the protruded point, in moving it by a smart stroke with a stone; in this I was not disappointed, and with the assistance of extension, completely succeeded in extracting the implement.

The man was ordered to be put on a mattress, and carried to a tent; the wounds were superficially dressed.

11o'clock, A.M.—Patient has made water twice, but with considerable pain; is otherwise tolerably easy; venæsectio ad ℥xx.; natron vitr. ℥iss., one part to be taken immediately, and to be repeated in two hours if necessary.—2 o'clock, P. M. No evacuation from the medicine; an enema immediately; pain by no means severe.—4 o'clock, P. M. Has had three or four stools, and feels himself much relieved; has made water two or three times, but still accompanied with pain; urine not tinged with blood; ordered to take nothing but tea. 8 o'clock, A.M. Has suffered but very little pain; slept for about half an hour.

March 20th. Has slept several hours in the night; made water two or three times; suffers slight pain occasionally on turning himself in bed; has the perfect use of his lower extremities; pulse rather full; skin cool; repet: venæsectio ad ℥xx; to continue his tea, as yesterday—7 o'clock, A. M. Has been perfectly easy; makes water with less pain.

March 21st. Has passed a good night, and feels perfectly easy and comfortable.

March 22nd. No evacuation since the 20th; pulse rather full; venæsectio ad ℥xij. natron vitr. ℥j.—7 o'clock, A, M. Medicine operated three or four times; feels no pain in passing water.

23rd. Has passed a good night; wounds dressed; is allowed a small proportion of bread with his tea.

24th. Going on in every respect well.

25th. Bowels regular; no pain in making water, nor did he ever pass blood per anum.

28th. So far recovered as to be able to be removed to Elvas.

(Signed) JOHN MALING, Surgeon,
1st. Battallion, 52nd Regt.

*Camp, Badajos, April 1st.* 1812.

To G. J. Guthrie, Esq.

In the *Gazetta Toscana della Scienze Medico-Fisiche* for June, 1844, M. Scarutti has related the case of a woman five months advanced in pregnancy, who fell upon a stake, which entered the upper and back part of the thigh, passed upwards, and could be felt in the back, on a line with the exterior margin of the sacro-lumbalis muscle. In trying to withdraw the stake, it broke off about seven inches within the thigh, and the upper part could only be removed the next day by an incision in the loins, through the integuments, muscles, and finally the peritoneum. It was found necessary to push down the piece of wood to disengage it from the two lower ribs in order to extract it,—a knotty stick eight and a half inches long, and between three and four in circumference. The edges of the wound were closed by suture by the operator, M. Vannoni. Reaction soon took place, requiring several bleedings. Abortion occurred six hours after the operation. The catheter was used for several days. The woman recovered in three months.

M. Bessons has related in the *Annales de la Societé de Médécine d'Anvers*, the case of a lad, fourteen years of age, who fell from a bed four feet high on an iron spindle, blunt at the point, about a foot long, and as thick as a crow-quill, which was inserted into a wooden block. Pinned by the buttock, he saw the point of the spindle sticking through his trowsers by the side of the navel, whence it was withdrawn by his mother. Sent to the hospital, the lad was dismissed cured at the end of twenty days, without having undergone any particular treatment.

That a blunt instrument, like the small end of a ramrod, should be forced between the loose viscera of the abdomen without wounding any of of them, may be easily conceived; but that balls or sharp pointed swords should do so, is not to be understood so easily. Ambrose Paré, our own Wiseman, Ravaton, Lamotte, Muys, and others, have related instances of this kind, in which the patients recovered in an inconceivably short space of time, but these and other recoveries of a similar nature must be considered as exceptions to a general rule.

Wounds penetrating the wall of the belly, when made by cutting or lacerating instruments, or by musket balls, are usually followed if to any extent, by a protrusion of some portion of the contents of the cavity; generally of the omentum or intestine, if not of both. This may take place at the rounded orifice of entrance of a ball, as well as at the more slit-like opening of exit, which, if the patient should recover, becomes closed by a thin tendinous-like expansion, under the cicatrix formed by the common integuments. These soon yield to the general pressure on the abdominal cavity, and admit of the formation at the part of a ventral rupture, requiring the application of a restraining bandage.

When a piece of omentum only protrudes, the direction given by the latest writers on surgery is, that it shall be returned into the cavity of the abdomen whence it came, the finger following to ascertain that it is quite free; after which the wound is to be carefully closed by sutures applied close to the peritoneum, so that the omentum may not again protrude through it. Having objected already to the manner of employing the suture, I now object to the treatment of the omentum, and do not approve of its being so dextrously returned within the peritoneum, to its natural loose situation. I desire, on the contrary, that it may be retained between the cut edges of the peritoneum, but without the slightest pressure, or possible strangulation; in order that by its retention it may more readily adhere to these edges, and thus form a more certain barrier against the extension of inflammation, than is likely to take place by some accidental contact, when moving at liberty in the cavity of the abdomen, however closely it may be supposed to be applied to the inner surface of its paries.

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* I saw this man several times during his treatment. He marched with his regiment in the summer to Valladolid, and was drowned in the Douro, whilst bathing near that city.—G.J.G.

It sometimes happens that a portion of omentum is altogether without the cavity of the abdomen, and the opening through which it is protruded seems too small to allow of its restoration to the cavity. The latest authors on this subject direct that a blunt director is to be introduced between the upper edge of the wound and the protruded part, be it omentum, or intestine, or both, upon which a blunt ended bistoury is to be passed into the cavity as far as the enlargement of the wound seems to require, after which the director and the bistoury are to be withdrawn together. I dissent entirely from this. It is scarcely ever necessary to enlarge the opening in the peritoneum, the obstacle to reduction being situated in the tendinous expansion or aponeurosis of the wall of the belly, the slightest division of which will give sufficient space for the restoration of the protruded part, in almost every instance. I have unavoidably opened into the cavity of the peritoneum in two cases in which I tied the iliac artery, in both of which I took the greatest pains to prevent this accident. I have seen it done in other instances, but no inconvenience follows these small openings not exceeding a quarter of an inch in length, when they are properly covered over by the healthy parts. I have seen disastrous consequences follow larger ones; it is, therefore, important in all cases to have as small an opening as possible in the peritoneum, and certainly no addition should be made to the size of a small opening if it can by any possibility be avoided, however indifferent a quarter of an inch, more or less, may be in the length of a large one. All protruded parts, whether omentum or intestine, should be gently cleansed with warm water, and the fingers of the surgeon should be wetted in a similar manner, the mesentery being returned first if protruded, then the intestine, and lastly the omentum or caul; the two former under all circumstances; the latter, not so, if it be adherent or inflamed, torn or jagged, or in a state of suppuration or gangrene. It should, in these cases, be left to itself, and treated in the most simple manner; a ligature should never be applied to it, neither should it be spread out and cut off, as was formerly recommended, as it will gradually retract, and be withdrawn into the cavity of the abdomen. If suppuration should take place in its substance, and the swelling of the part lead to its constriction, or the formation of matter under the integuments, or between the layers of muscular or tendinous fibres, these may be carefully divided; but I apprehend it will rarely be necessary to cut the peritoneum in such cases, or that it has ever been done with advantage to the patient. It gives me pleasure to find that the directions thus expressed, and which have been promulgated in my lectures since the year 1816, are supported by the opinion of Baron Dupuytren in his Leçons Orales, and by Baron Larrey, in the third volume of his Memoirs and Campaigns, page 439; a concurrence of opinion which is the more gratifying to me, inasmuch as it is the result of experience gained in a similar manner, at a nearly similar point of time, the proceedings of each, which led to these conclusions, having been unknown to the other.

Several cases, on different occasions of neglected penetrating wounds during the Peninsular war, among the Portuguese and Spanish troops, as well as the English, taught me that a wound of the integuments of the belly, with the omentum protruding through and filling it up, could recover with very little comparative assistance. I have, in my work on "Inflammation, Mortification, and and Gun-shot Wounds," noticed the difference between the proneness to inflammation of persons of our Northern constitutions, when compared with those of the inhabitants of more Southern climes; and that whilst our soldiers were perishing from inflammation, which could not be subdued, it was scarcely in excess among many of the Portuguese and Spaniards, suffering from similar injuries; although there are certain states of injury, from which none of any nation can recover, the period of dissolution being merely delayed. It was from the consideration of several of these cases, that I came to the conclusion that it is satisfactory to see the omentum resting between the edges of a wound in the peritoneum, and that it is the right and proper treatment not to molest, but to close the wound in the integuments over it, by the continuous suture, in the manner already recommended.

Case 14.—Evan Thomas, aged 17, admitted into the Westminster Hospital, Sept. 1, 1828, having been stabbed with a dinner-knife immediately above the umbilicus; the wound was three-quarters of an inch long; the omentum protruded, and could not be returned, until the skin, cellular membrane and fascia were divided, the opening in the peritoneum being then distinctly seen, and against the inside of which the omentum was left, the wound in the skin being sewed up by the continuous suture. In the evening he was bled to ℥xvi, and as he had thrown up his dinner, an enema only was administered. On the 2nd, the belly being tense and slightly painful, although he was not in constant pain, and the blood drawn before being buffy, twenty-two ounces more were taken away, an enema purgans administered, and as the bowel was not believed to be injured, four grains of calomel and six of the compound extract of colocynth were given in two pills, with a draught of senna and salts every four hours. 3rd. The bowels open; no pain and scarcely any uneasiness on pressure; abdomen soft. No food, barley water and gruel, pulse 84. On the 6th the sutures were removed, the wound having united. He was then made an out patient, having a comfortable home.

Case 15.--A soldier, of the 2d division of Infantry, received several stabs from a lance, in different parts of the body, at the battle of Albuhera, as the Lancers rode past him, whilst lying on the ground, one only being of any importance, which was on the right side and lower part of the belly, and through which a portion of omentum protruded. On my reducing this, the epigastric artery, which had been divided, bled freely, the pressure on it being removed; a ligature was readily applied, and the wound closed by the continuous suture. The patient, after running great risk, and undergoing a very rigorous treatment, recovered.

Case 16.--A Spanish soldier was wounded in a scuffle in Madrid, in 1812, at the gate of the British Hospital, near the Prado, into which he was brought, with a wound in the right side of the abdomen, near and below the umbilicus, through which a portion of omentum protruded, to the size of a small orange. As this could not readily be returned, I carefully enlarged the wound, some three or four hours afterwards, at its under part by dividing the skin; and then found that it was the aponeurotic or tendinous expansion of the muscles, going to form the sheath of the rectus, which prevented the return of the omentum into the belly; on the division of this part it slipped back without difficulty, but as it did not recede further than the peritoneum, I left it there, and closed the wound, which was about an inch long, by sewing it up in the manner I have described. He was bled and starved, and was delivered up to the proper authorities with his wound nearly healed, when we evacuated the place.

Case 17.—A Spanish soldier, standing, in all probability, sideways towards the enemy, was wounded at the battle of Toulouse, by a small musket-ball which passed in on one side, and came out at the other, carrying with it a portion of omentum, which gradually became as large as an orange, in which state I saw it four days after the accident. Little had been done; he had not suffered much pain, although the abdomen was tender; he had vomited; passed blood with his motions; was feverish and ill. I visited this man every three or four days; he suffered from privations of every kind, and each time found him better. The protruded omentum gradually diminished in size, and was at last drawn into the wound in the abdomen, and covered by granulations. He left Toulouse before me, nearly well.

Baron Larrey recommends that the protruded omentum should be left *in situ*, when not strangulated, if it cannot be readily returned, and relates some cases to prove that it will, if gently treated, be gradually drawn within the abdomen, by the efforts of nature This I have also seen, but in others, and perhaps complicated cases, in which it has been left outside, or cut off, fatal consequences have ensued, not perhaps on this account alone; nevertheless I am indisposed to leaving any portion of it outside the abdomen, if it can be returned in a healthy state. If greatly bruised, or injured, it may be cut off, and the vessels tied if bleeding, but I do not recommend its being returned further than the edges of the peritoneum, over which the external wound is to be closed.

M. Hyppolite Larrey, the son and able successor of his father, the late Baron Larrey, has related the history of a penetrating wound of the abdomen in which the omentum protruded, in a Memoir presented to the Royal Academy of Medicine, of Paris, 1845, in which, finding he could not restore it readily to the cavity of the abdomen, he covered it with a poultice and oiled silk, treating the case otherwise antiphlogistically. Considerable inflammation followed for the first day or two; on the fourth, a suppurating surface was established. On the tenth, it began to be withdrawn, and on the thirty-sixth, it was reduced to the level of the skin. In forty-six days, the patient was cured.

Dr. Hargrave, of the City of Dublin Hospital, in 1839, in a similar case, thought it advisable to place a ligature around the protruding omentum on the fifth day; and to tighten it when it became loose. It came off three days afterwards, and the patient was discharged cured in twelve days after the accident.

A case occurred lately in King's College Hospital, in which three inches of omentum, protruding from a small wound above, and to the right of the umbilicus, in a child of four years old, were cut off, close to the abdominal parietes, by the house-surgeon; a compress of lint was applied, with sticking plaster and bandage, and the child did well in four days.—*Provincial Medical Journal*, vol. 8, 1845.

These cases shew what may be done, but not what it is generally advisable to do.

Ravaton wrote, a hundred years ago, page 607, " The views of a surgeon must be very confined, who advises the application of a ligature to the omentum, when protruding from the cavity of the belly in a healthy state. It is a cruel and deadly manœuvre, contrary to reason and experience. To restore it to its place, is so simple, just, and reasonable, that I am surprised it does not occur to every one. The reduction is easily effected. It is sometimes difficult to retain the reduced part, except by sutures. I admit that when the omentum is strangulated, gorged with blood, black, and about to become gangrenous, the result of its restoration to the cavity may be doubted; yet experience has demonstrated that it is the safest mode of proceeding, taking care not to close the wound entirely, but to leave an opening at the lower part, to give vent to any effusion or suppuration that may take place."

When a portion of intestine is protruded without being wounded, it is to be returned, whatever may be its state, unless it be soft and unresisting between the fingers, of a dull blue or black colour, and to every surgical eye, deprived of life, or mortified. At any state previous to this (to Englishmen) almost certainly fatal condition, it should be restored into the cavity of the abdomen. When a portion of intestine is thus returned, three directions are given, by most modern surgeons, and especially by Chelius, section 517, on which his English editor, Mr. South, makes no comment, and which may, therefore, be considered to be those which are commonly taught in London, but which I entirely disapprove. The first is, that the peritoneum is to be divided, in cases in which an obstacle is interposed to the return of the intestine ; this I aver to be less necessary for the intestine than for the omentum. The second is, that "after the reduction, the fore-finger must be introduced into the cavity of the belly, in order to ascertain that the intestines have not passed into the interspaces of the muscles;" A precaution which is unnecessary, and may do much mischief. The third is, that the patient is then to be placed "in such a posture as that the intestines should least press against the wound;" to which direction I object. The surgeon should certainly take care that the intestine does not pass between the layers of muscle, nor any where else, than into the cavity of the belly. So far, however, from the intestine being pushed away from the cut peritoneum, the most favourable position for it would be, to be applied against the edges of the cut membrane, and even rising up, for the least possible distance, without or above it; the great object to be desired being to facilitate adhesion, by as perfect an apposition of these parts as possible, whilst the external wound is accurately closed by the continuous suture, and duly supported by adhesive plaster compress and a bandage, provided it be methodically applied. The next best thing which can happen is, that every part being relaxed, and the patient perfectly quiescent, the intestine should press so steadily, and yet so gently against the wounded peritoneum, that it must be kept in constant apposition with, without protruding through it.

CASE 18.—A soldier of the Artillery, was stabbed in 1813, with a long knife in two places, by a towns-man, late in the evening, and was carried into the hospital for the sick and wounded French prisoners, in Lisbon. The wound in the belly was situated somewhat more than an inch to the right side of the umbilicus, and was about an inch in length from above downwards; through it a considerable protrusion of small intestine, without any omentum, had taken place. This was distended by flatus, and of a dark brown colour, when I first saw it, some time after the receipt of the injury. The bowel being constricted by the tendinous expansion of the muscular fibres, the latter was carefully divided by a blunt-pointed curved bistoury passed under its upper edge, and resting on the back of the nail of the fore-finger, by which the intestine was guarded; the flatus having been pressed out of the intestine, which was gently washed with warm water, it was restored to the cavity of the abdomen, the part last protruding being first returned, without any enlargement of the cut in the peritoneum. Of the part which had apparently first protruded, the peritoneal coat and a few fibres of the longitudinal layer of muscle were divided to the extent of half an inch, the remaining portion of the gut being unhurt. The skin was then sewed up by a fine continuous suture, and adhesive plaster, and a compress duly applied. A good deal of alarm was evinced, the pulse was very small, and the man faint. The other wound was in the back, about half an inch in extent, and near the inferior angle of the right scapula. It appeared to be a penetrating wound, but not giving rise to any peculiar symptoms, he was placed in bed on his back, with his legs raised, and the body slightly bent. Early the next morning, the officer on duty found it necessary to bleed him largely to forty ounces, according to my directions, on account of pain which had come on in his bowels, and in his back, accompanied by difficulty of breathing, the skin being hot, and the pulse quick and hard. The cellular membrane around the wound in the back was emphysematous; there was a slight cough, accompanied by an expectoration slightly tinged with blood. The bleeding removed the essential symptoms, but the pain and difficulty of breathing returning next day, it was repeated to eighteen ounces, with an equally good effect. It was necessary to repeat it on the third, fourth, and fifth days, when the pain ceased to return, and the pulse instead of being small and hard, became softer and fuller. The bowels were opened naturally on the third day, and the emphysema had gradually disappeared, no food being allowed and very little drink for some days, which was then only given in small quantities of the simplest kind. The threads were removed with scissors on the sixth day, and the man was free from complaint, although very weak, at the end of five weeks.

CASE 19.—Dr. Long, of Arthurstown, has related a case in the 15th vol. of the *Dublin Medical Press*, in which he reduced a portion of omentum, stomach, and colon, as large as a child's head, which had protruded through a large wound in the abdomen made by a knife. The external parts were brought together by five stitches of the interrupted suture, assisted by adhesive plaster. The man was bled and leeched several times, and rigid abstinence was enforced. Calomel and opium were administered, and on the 16th day he was able to leave his pallet, in a miserable cabin, in which he was destitute of all material comfort.

Case 20.—Dr. Worthington, in the *American Medical Examiner*, has related the case of a labourer, who, having been forced against a cart, received two wounds in his abdomen; one, running above Poupart's ligament on the right side, eight inches long, through which eighteen inches of colon, and thirty of small bowel, protruded. The other was a small wound below the umbilicus, on the left side, through which a small fold of intestine also protruded. The patient did not complain of pain. These parts having been restored to the cavity, the wounds were closed by sutures two inches apart, and the patient rapidly recovered, without once having been blooded; an exception, certainly, to the general rule, of inflammation not following such a wound.

Case 21.—Rosier de Landau having been called to a boy who had been gored by the horn of a bull, and a wound made from the groin to the umbilicus, through which the intestines protruded, restored them without difficulty. The next morning the boy walked three miles to see him, carrying the bowels, which had again protruded, in his shirt. He recovered in three weeks.

Case 22.—Madame Doucet was applied to, a hundred years ago, by a soldier, who, having been struck by a halbert, had a wound made across his abdomen from above the ilium, through which a great part of his bowels protruded, and which he carried in his hat, enveloped in his shirt. Having had to walk between three and four miles, in the heat of July, to the old lady, his bowels were as dry as parchment by the time he arrived. She, therefore, bathed them in warm milk and water, until they became soft and natural in appearance; she then returned them into the cavity of the belly, and sewed up the wound with a well-waxed silken thread--thus setting an example which ought to be followed in 1847. The man recovered.

When the protruded intestine is wounded, the case is complicated, and much depends on the size of the wound. A mere puncture, or a very small cut, is often of no consequence, and does not require any treatment; the bowel should merely be returned to the cavity of the belly, and the symptoms of inflammation closely watched, and if possible, steadily subdued.

Case 23.—A soldier, of the 29th regiment, received, on the heights of Roliça, in 1808, a stab from a sword, which made a small opening in the abdomen, yet sufficiently large to allow the protrusion of a small piece of intestine, probably from walking down very steep and rugged ground to come to me. In this there was evidently a small puncture, made by the point of the instrument. I immediately returned it, sewed up the cut in the skin, and applied some sticking plaster and a compress. The man recovered, with very moderate symptoms of inflammation.

Upon the treatment of cases of this description there can be no difference of opinion, although I have seen many lost under similar management, in which no more injury had been committed. The recovery of other persons from wounds which might, on the contrary, be expected to prove mortal, renders any correct prognosis not only difficult, but almost impossible. Wounds of the cavity of the abdomen require the strictest care, an unremitting attention, and yet occasionally baffle all skill and knowledge; whilst at others they appear to set all rules, all received opinions, at defiance, of which the following may be taken as an example, from one of our oldest writers.

Littre, in the *Memoires de l'Academie Royale des Sciences*, for February 1705, relates the case of a young man, of a good constitution, who, while labouring under mental derangement, stabbed himself in the belly in eighteen different places, believing it was a lump of butter into which he was sticking his knife. Eight of these wounds penetrated into the cavity of the abdomen, and were followed by fever, tension of the belly, difficult respiration, nausea, and vomiting; he passed also, by the bowel, clots and portions of blood. He recovered in two months, having been bled seven times from the arm, in four days, each time to a considerable quantity (*quatre palettes*). In the largest wound a soft tent was daily placed, moistened with the balm of Arceus, for the purpose of allowing the escape of any extravasated matters; but, as very little was evacuated, the tent was soon changed for a simple compress. He gradually recovered, and, seventeen months afterwards, threw himself out of a window, three stories high, and died on the spot. On opening the body, the middle lobe of the liver was found adhering to the wall of the body, having a cicatrix on it, three lines long, and half a line broad. Two portions of the jejunum were adhering to each other below the stomach, on the right side; on separating the adhesion between them, the left portion of intestine showed a transverse cicatrix on it, three lines and a half long, and two-thirds of a line broad, corresponding with the direction of the scar in the skin. The opposing surface of the bowel had no mark on it, and had merely accepted the agglutinative process offered by the wounded part applied to it. On the anterior part of the colon a very oblique cicatrix was seen, five lines in length, and one and a half in width, from which eighteen or twenty filaments proceeded through the cleft in the peritoneum and the muscular wall of the belly, to the cicatrix in the skin.

It is advisable, in investigating this subject further, to consider the abdomen as devoid of cavity during life and health, the contained parts being so gently pressed upon by the containing and retaining muscular parietes around, as to enable them to carry on all their ordinary functions, unless suffering from some derangement, exclusive of that which might arise from a deficiency of the pressure usually exercised upon them; but that this pressure can, or generally will prevent the effusion of the contents of a bowel when ruptured, if the wound be half an inch in length, or that it will prevent the extravasation of blood from an artery or vein, of moderate dimension, if torn, is contrary to facts now considered indisputable, as I have frequently had occasion to verify. That a mere puncture of the intestine does not allow the effusion of air, much less of the contents of the bowel, is not doubted. The size of the opening, which will admit of the passage of both, is however, a point in doubt; and although many surgical facts have been adduced, proving that persons have recovered from wounds of arteries and veins, and even from rupture of an intestine, the size of such opening, in whatever way it may have been made, has always been small, and the effusion, if any took place, was confined to a spot, and cut off from the general cavity of the belly. When the contents of the bowel have been more largely poured out, without an external opening, through which they might escape, inflammation and death have ensued, at no long distance of time. When blood is poured out from the great vessels, as in ruptures of the liver, or spleen—of which instances will be adduced—the general cavity may be filled; but when the injury is less extensive, or the lesion less important, the blood usually gravitates towards the back, or sinks into the pelvis. It is possible that blood may be effused in small quantity, and be then confined under the general pressure of the wall of the abdomen, and the resistance offered by its contents, to a particular spot, whence it may be absorbed after coagulation; or, by commencing decomposition, give rise to irritation, and be discharged through the external wound, if one should have existed, or through the bowel with which it may happily have been in contact.

Case 24.—A soldier, belonging to the 2nd division of infantry, was wounded by the Polish lancers, at the battle of Albuhera, in several places slightly, and in the abdomen severely, a penetrating wound having been made an inch long, between the umbilicus and the crest of the ilium, on the left side. Brought to me the day after at Valverde, the edges of the wound were stitched together by two sutures through the skin, and dressed simply. He said it had bled freely at first, and was then painful. Treated antiphlogistically and sharply, the inflammatory symptoms gradually subsided. The bowels were relieved by gentle aperients, there being no reason to suppose they had been wounded. A small oval swelling was soon perceived under the wound, which was tender to the touch, indicating mischief of some kind. The edges of the wound, which did not unite fully, although they were retained in contact, at last separated, and allowed about a wine-glass full of bloody matter to pass out, which reduced the swelling, and removed the uneasiness and pain of which he complained. After this he gradually recovered, and was discharged to Elvas, whence he went on to Lisbon. Whenever I have seen larger effusions of blood, the sufferers have usually been lost, from the occurrence of peritoneal inflammation. That small ones may be absorbed, I am satisfied; that they have been discharged by the bowel, I have I feel assured seen instances, as well as of recovery. I have never been so fortunate as to see a general formation of matter from effusion, and to have opened the abdomen, for the evacuation of its contents with success; although I do contemplate that such cases may occur, and surgery may come to their relief with good effect, and to this I pointI shall hereafter draw particular attention.

# LECTURE II.

*The coats of the stomach and intestines; The third coat, or fibrous lamella; Cruveilhier's description of this coat; Mr. Quekett's account of this structure in animals; Dr. Gross' account of this coat in the African lion; Dr. Gross on its alteration in malignant diseases of the human stomach; Mr. Travers' experiments on the nature and results of injuries of the intestines; Dr. Gross on the eversion of the lining membrane of the intestines, as distinguishing traumatic injuries from ulceration of the bowels; Conclusions to be drawn from Dr. Gross' experiments; Mr. Travers' and Dr. Gross' experiments on the intestines, by enclosing them in a tight ligature, and the results; Consequences of applying a small ligature round the edges of a wound in the intestine; Manner in which wounds of intestines are closed; Sewing together, and thereby restoring the continuity of the bowel, first practised by four surgeons of Paris, by the intervention of an animal's trachea—Jemerius, Roger, and Theodoric, used a canula of elder wood for that purpose—Gilbert de Salicetti, the dry and hardened bowel of some animal; These proceedings only adopted in incomplete division of the intestine; The method of the four masters recommended by Duverger de Maubeuge; Ramdohr's operation of introducing the upper end of a divided intestine into the lower; Attempted by Moebius and Dr. Smith, but unsuccessfully; Causes of the failure; Experiments of Louis with this operation on animals; The operation a failure in the hands of Boyer, but successful in those of Laveillé, Chemery Have, Schmidt, and others; Bichat and Richerand's objections to this operation; Dr. Zina Pilcher's case of divided intestine, in which he successfully introduced the lower end of the bowel into the upper; Sir Astley Cooper and Richter's plans of proceeding; Palfin's mode of treatment of a divided intestine; Recommended by John Bell, Scarpa, Gibson, S. Cooper, Syme, and others; The practice strongly condemned by Dr. Gross, and its supporters severely censured; Le Dran and Béclard's modification of Palfin's operation; Bertrandi's* suture à points passés *supported by Sabatier, Chopart, Desault, and Boyer; Mr. Calton's case of lacerated and penetrating wound of the abdomen, with wound of the ileum; Sir Astley Cooper, Mr. Lawrence, and Dr. Gibson's cases of a small opening in the intestines secured by ligature; Where the opening is more than two lines in extent, a simple stitch is preferable to the ligature; M. Denan's apparatus, with hollow metallic cylinders, and M. Baudens' metallic ferule, employed in the treatment of divided intestine; M. Raybord's wooden cylinder apparatus, and the mode of employing it; M. Jobert's modifications of Ramdohr's operation; Cloquet and Jobert's cases of wounded intestines; M. Lembert's method of closing the divided intestine by suture, without the introduction of an extraneous substance within it; Mode of performing the operation; M. Baudens' case of musket-shot wound of the colon, successfully treated by the method of Lembert; Dupuytren's modification of Lembert's operation; Dr. Gely's* suture en pique; *Difficult of execution, and liable to objection; Mode of operating; M. Jobert on the advantages of his operation; M. Jobert on the elimination of the ligature; M. Dieffenbach's case of excision of part of the intestine, in the operation for strangulated hernia; Dr. Gross' experiments on Lembert's operation; Best mode of applying the suture in divided intestine; Mr. Travers' directions; M. Nuncianti's spiral suture; Cases; Greater danger of wounds of the small, than of the large intestines; Mr. Guthrie's method of treating wounds of the intestines; Dr. Bingham's case of excision of a considerable portion of the intestines in a lunatic, with a successful result.*

Anatomy has demonstrated that the stomach and intestines, particularly the smaller ones, are composed of four distinct coats, or tunics; first, the external peritoneal, or serous covering; second, the muscular, separated into an external or longitudinal layer, and an internal or circular layer; third, the fibrous coat, or lamella of Cruveilhier, the membrana nervosa of Haller, cellulosa of others of the older writers; and fourth, the mucous, villous, or internal coat, constituting its inner lining. The third coat, or *fibrous lamella*, is the only one deserving of further remark, in the present state of our knowledge, its existence as a distinct tunic having been denied by some anatomists, and maintained by others. Cruveilhier says, *Anatomie Descriptive*, tome 2, page 470; in the *Library of Medicine*, edited by Dr. Tweedie, vol. 7, page 473, "The fibres of this coat have not a parallel arrangement, like those of aponeuroses, or fibrous sheaths, but form a very distinct net-work, the filaments or lamellæ of which can be separated by inflation, or infiltration. It is concerned in a very important manner, in chronic diseases of the stomach, is very liable to hypertrophy, and in certain cases, acquires a thickness of several lines."

Mr. Quekett, the assistant conservator, who has examined this tunic, at my request, in the different preparations in the museum and stores of the Royal College of Surgeons, informs me that it is much stronger, firmer, and more elastic, in reptiles than in other animals, more distinct in carnivorous than in herbivorous animals, or in man, according to the following table:—

1 Alligator.
2 Turtle.
3 Leopard.
4 Cheetah.
5 Horse.
6 Pig.
7 Peccary.
8 Seal.
9 Dog.
10 Cat.
11 Man.
12 Porpoise.
13 Chimpanzee.
14 Monkey.
15 Bear.
16 Ox.
17 Rat.
18 Rabbit.

Dr. Gross, of Louisville, U. S., in his late most able and excellent work, entitled "*A Critical Enquiry into the Nature and Treatment of Wounds of the Intestines*," says "In the small bowel of the African lion it is an exceedingly firm, dense, and elastic texture, of a white opaque aspect, capable of great resistance, and nearly half a line in thickness." "In malignant affections of the stomach in man, it is often remarkably altered in its structure, being rendered much thicker than in the normal state, at the same time that it assumes a dense and almost gristly hardness." It readily re-unites when divided, and is deserving our utmost attention, being the part through which the surgeon should always carry his needle, in sewing wounds of the intestines, whether or not he includes the internal or mucous lining of the bowel.

Never having made experiments on living animals, for the purpose of ascertaining the nature and results of injuries inflicted upon their intestines, I refer to those who have recorded their observations on this subject, and particularly to Mr. Travers, whose very able and philosophical work, entitled "*An Inquiry into the Process of Nature in Repairing Injuries of the Intestines*," (London, 1812) is deserving the most attentive consideration. He says, page 85, "if a gut be punctured, the elasticity of the peritoneum and the contraction of the muscular fibres open the wound, and the villous or mucous coat forms a sort of hernial protrusion, and obliterates the aperture. If an incised wound be made, the edges are drawn asunder and everted, so that the mucous coat is elevated, in the form of a fleshy lip." If the section be transverse, the lip is broad and bulbous, and acquires tumefaction and redness, from the contraction of the circular fibres behind it, which produce, relatively to the everted portion, the appearance of a cervix. If the incision is according to the length of the cylinder, the lip is narrow; and the contraction of the adjacent (superincumbent) longitudinal, resisting that of the circular fibres, gives the orifice an oval form. This eversion and contraction are produced by that series of motions which constitutes the peristaltic action of the intestines."

Dr. Gross says, page 11, that "the eversion of the lining membrane, which is so conspicuous in traumatic lesions of the alimentary tube, is never witnessed in the openings which result from ulcerative action. There is thus a striking difference, as respects their immediate effects, between an opening of the bowel from ulceration, and one produced from an incised or lacerated wound. In the former, although it may not be two lines in diameter, extravasation would be almost certain; in the latter, it might be nearly double that size, and yet, for the reason just mentioned, that event, so much to be dreaded, would be little likely to occur."

The important conclusions to be deduced from his experiments are, first, that wounds not exceeding four lines in length (or the third part of an inch), no matter what their direction may be, are not so apt, as might be supposed, if left to themselves, to be succeeded by extravasation of the contents of the intestinal tube; and that, in the majority of cases, nature properly aided by art, is fully competent to effect reparation. Secondly, that wounds of the bowels, to the extent of six lines, whether transverse, oblique, or longitudinal, are almost always, if not invariably followed by the escape of the contents of the bowel, and the consequent development of fatal peritonitis. It may therefore be concluded from these experiments made on animals, as far as they can be relied upon with reference to man, that every wound in the bowel, of such extent as shall not admit of its being temporarily filled up by the protrusion and eversion of its internal or mucous coat ought, if possible, to receive assistance from art, which can only be given with advantage in the first instance.

Mr. Travers tied a thin ligature firmly round the duodenum of a living dog; the ends were cut off, the parts returned, and the external wound properly closed. On the fifteenth day, the cure being completed, the dog was killed. A portion of omentum, connected with the duodenum, was lying within the wound, and the folds contiguous to the tied part of the intestine, adhered to it at several points. A slight depression was observed around the duodenum, the internal or mucous surface of which was more vascular than usual; a transverse fissure marked the seat of the ligature. "The lymph," Dr. Gross observes, page 26, "which is effused upon the external surface of a bowel, consequent upon such an operation, gives the part at first a rough, uneven appearance; but, if the animal survive several months, it is generally no easy matter to determine the seat of the injury, from the external appearance of the part. Internally, the cicatrization is almost as complete, the continuity of the mucous membrane being every where established, leaving scarcely even a seam at the original seat of constriction. The rapid manner in which the ligature cuts its way from without inwards, obviates the evils which might arise from the occlusion of the passage." In a small but full-grown dog, killed at the end of the third day after the experiment, Dr. Gross proved that the ligature, which was round and narrow, had made its way through more than one half the circumference of the tube. In another dog, which died from the effects of the operation thirteen hours later, the ligature had entirely disappeared, and was discovered at the distance of several feet from the seat of injury. In a third experiment, in which the dog was killed upon the eleventh day, the canal of the bowel was completely restored, and the bond of connection between the divided parts was firm and organised.

Similar effects are produced when a small ligature is applied around the edges of a wound, from two to three lines in diameter, provided it be drawn with sufficient firmness, not to slip off. The process of reparation is not, however, so speedily completed, owing to the breach being much wider than when a ligature is simply placed around the tube. The mucous membrane requires a longer period for its reproduction, and the quantity of lymph deposited around and enclosing the ligature is proportionately greater.

The cases recorded by the older writers in surgery, in which opportunities were afforded of examining the parts some time after they had been injured, in consequence of the deaths of the sufferers, show that the closure of the wound in the intestine had usually taken place, when unassisted by art, through the adhesion of the cut edges to a neighbouring part, against which they had been applied. In other instances, the opening was closed by a deposition of lymph, and the gradual approximation of the edges of the wound. This however rarely takes place, unless the agglutinative fibrine is secreted in considerable quantity; which may even include within itself a foreign body, thus rendering it harmless, until some cause of irritation shall take place, giving rise to inflammation and ulceration, when the offending substance may be, luckily for the patient, carried into the bowel; the knowledge of which facts we owe to the late Dr. Thomson, of Edinburgh.

The idea of sewing together, and thereby restoring the continuity of the bowel, is attributed to four surgeons of Paris, who, having united their efforts for the relief of the sick poor in that city, in the thirteenth century, procured it is said, a portion of the trachea of an animal, one end of which they introduced into the upper part of the divided bowel, and the remaining piece into the lower, and then brought the divided ends into contact, and retained them by as many sutures as appeared to be necessary. Their writings, in which this operation is described, are lost. Peter De Argelata, who lived about the middle of the fifteenth century, says that Jemerius, Roger, and Theodoric, supported the intestine by a canula of elder wood, whilst Gilbert de Salicetti condemns both the use of the trachea and the elder-wood tube, and recommends if anything be used, that it should be the dry and hardened bowel of some animal. These ancient surgeons believed that a transverse division of the intestine was necessarily a fatal injury, and only resorted to the methods they recommended, when the division was less complete. Duverger de Maubeuge, in the beginning of the eighteenth century, apparently unaware of what had been done before his time, brought forward this method of the four masters as an invention of his own. He cut off a portion of mortified intestine, in a case of strangulated hernia, introduced a piece of the trachea of a calf, brought the divided intestine over it, and fastened it by a suture. The trachea was passed on the twenty-first day, and the external wound was closed by the forty-fifth, the patient recovering.

Ramdohr, a German surgeon, who lived in the early part of the last century, seems to have been the first to join the ends of a divided bowel, by introducing the upper end within the lower. He removed two feet of mortified intestine in a case of strangulated hernia; performed this operation on the ends of the bowel, retained the parts by stitches, and his patient perfectly recovered. Heister, in his *Institutiones Chirurgicæ*, vol. 1, page 768, says the mortified parts were in his possession. Moebius gave the first relation of this operation in his thesis, read before Heister, at Helmstadt, in 1730 (Haller's *Disputat. Anatom.* vol. 6. *Observ. Med. Miscel.* 18), but failed on repeating the experiment on a dog, being unable to introduce the upper into the lower end, in consequence of the struggles of the animal, and the inversion of the cut edges of the mucous membrane. Dr. Smith, of Philadelphia, did not succeed in a similar attempt, although he had partly filled the upper portion of intestine with a tallow candle, and divided a small portion of the mesentery, as Ramdohr directed, to facilitate its introduction. He failed, as those who have followed him have since done, in consequence of the contraction of the cylinder of the bowel, and of the eversion of the mucous surface within it.

Louis, the illustrious secretary of the Academy of Surgery in Paris, repeated the experiments of Moebius with a very successful result on animals; which he attributed to the method he pursued, in dissecting away the mesentery from the upper end of the intestine, before he introduced it to the extent of the separation, into the opposite or lower extremity of the bowel.

M. Velpeau, in the fourth volume of his *Médécine Operatoire*, Paris, 1839, says, that in addition to the case in which Ramdohr succeeded, the operation has been attempted twice by Boyer; the first patient died, and he was not able to complete the operation on the second. In a case in which Velpeau himself saw it tried in the Hôpital St. Louis, the patient died the next morning; he says, that M. Laveillé,* M. Chemery Have, Schmidt, and some others, have each succeeded in saving the life of a patient by this operation.

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* Laveillé, Journal Générale de Médécine, tom. xv. p. 176.

Bichat, however, declared that adhesive inflammation could only take place between serous membranes, and not between a serous and mucous membrane, as in these operations. M. Richerand supported this opinion, and pronounced against the possibility of the operation being successful, according to the manner in which it had been described to have been done; and the acknowledged validity of this objection has led to the modifications which have since taken place; nevertheless Dr. Zina Pilcher, of the United States army, has detailed a successful case in the tenth volume of the *American Journal of the Medical Sciences*, 1842, in which he introduced he thinks, the lower end into the upper, instead of the upper end of the bowel into the lower, in the manner it was formerly directed to be done. N. M., a Cherokee, was stabbed on the 22nd of June, 1831, with a butcher's knife, which entering the abdomen at the left internal ring, passed upwards and inwards towards the median line, making a wound three inches in length in the skin, and another still more extensive in the peritoneum, followed immediately by a protrusion of several feet of intestines. The knife had divided the ileum diagonally, and separated two inches of the lower portion of the mesentery. The fold of intestine in contact with this, was cut on its convex side, two-thirds across; two other convolutions were transpierced, and the descending colon was partially opened, in the direction of its circular fibres. Three branches of the mesenteric artery bled pretty profusely, and were included in separate ligatures, the ends of which were cut off close to the knots. The extremities of the ileum were brought together by passing a needle, armed with a thread, through the upper portion from without inwards, thence into the lower part and out again, including half an inch of intestine in the stitch; after which it was returned through the upper end from within outwards. Three sutures of this kind made the intus-susception complete. The extremities of the ligatures were cut off near the peritoneal surface. The other openings of the small bowel were closed with the continued suture, the ends of which were left long, and so tied as to hang within the tube. The wound in the colon was united with a single stitch. The prolapsed intestines were next sponged with warm milk and water, and returned into the abdomen; a few pieces of the omentum, which had been injured by the knife, were excised, and the edges of the outer wound approximated by half a dozen turns of the continued suture. The external ligatures were detached on the 5th of July, and by the 11th of the month, the wound in the abdomen was completely healed.

Sir Astley Cooper, in trying the method of Duverger, used isinglass as recommended by Watson, with success in a dog, although the cylinder was closed by the contraction of the gut, and had been manifestly of no service, as a tube. Richter suggested, that the tube should be made of card, varnished, and dried. All these methods, have, however, fallen into disuse, although M. Velpeau thinks, that the proceeding of Ramdohr is deserving of further trials on animals, which being what I consider unnecessary cruelty, I cannot recommend.

Palfin, in his *Anatomie Chirurgicale*, tome 2, page 76, Paris, 1743, undervalued the operation of sewing up the intestine, having conceived the idea, that the divided ends could not unite, except through adhesion to the neighbouring parts. He thought, therefore, that he did all that art could do, by carrying a waxed ligature through the edges of the wounded parts, bringing it out through the external wound, and fixing it there by adhesive plaster and bandage; so as to keep the cut bowel in contact with the peritoneum lining the wall of the abdomen, to which it might adhere, or by being retained in, or nearly in apposition to the external wound, be in the most favourable situation for the prevention of the effusion of the contents of the bowel into the cavity of the peritoneum, and for effecting the formation of an artificial anus. Mr. John Bell strongly recommended this practice of Palfin's, in which he was supported by Scarpa, and latterly by Dr. Gibson of Philadelphia, Mr. S. Cooper, Mr. Syme, and others. Dr. Gross says, that Mr. J. Bell sinned, because he had not the requisite light to guide him; but comments with much greater, and perhaps deserved severity on the later writers alluded to, who he says, "have been instrumental in perpetuating an error for which modern surgery can find no excuse, and which deserves to be reprobated in the strongest terms, from the pernicious tendency it must exert upon the younger members of the profession, when inculcated by authorities so respectable and so very influential. Upon Scarpa, who affirmed that a wound of the intestine, whether longitudinal or transverse, should never be sewed up, and that the few who recovered when it had been done, escaped, not in consequence of the operation, but in despite of it, Dr. Gross is not less severe. He says, his case "is on a par precisely with that of John Bell. When this eminent surgeon was at such pains to criticise and condemn the practice of his namesake Benjamin Bell, he had probably little idea that the verdict of the profession would, in less than a quarter of a century, entirely reverse his decision, and treat him as unsparingly as he did his Scotch contemporary."

Le Dran, in his *Traite des Operations Chirurgicales*, Paris, 1742, thought he improved on the operation of Palfin, by introducing several loops or threads, a quarter of an inch apart, by which he drew the edges of the wound into apposition, and then twisted the ends of the ligatures or loops into one, which he attached to the external dressing. After five or six days, if the patient should live so long, the compound ligature is to be untwisted, and all the threads on one side are to be cut off, so as to allow of their being more readily drawn through, by the other. Béclard has lately suggested that the threads should be of two colours, so that they might be drawn in opposite directions, and thus equalize the strain on the lately united parts.

Bertrandi recommended a mode of uniting the edges of the wound by a suture, which is called by the French writers who followed him, *la Suture à points passés*. It was supported by Sabatier, Chopart, Desault, and Boyer, who say it does not cause any puckering of the wound, or diminish the calibre of the bowel. The edges of the wound being placed in contact, it is sewed up, beginning about the fifth of an inch from the extremity, leaving a long end or thread; the needle should then cross *obliquely* from side to side, the threads or stitches being about two lines asunder. When the sewing up is completed, the two ends are to be brought out, and fastened at the external wound. In a few days one end is to be cut short, and the other pulled upon, to promote its withdrawal.

CASE 25. Mr. Calton, of Collingham, near Newark, has related in the *Edinburgh Medical and Surgical Journal*, vol. 12, under date of Nov. 1, 1815, one of the most interesting cases on record, in support of the interrupted suture. The child, seven years of age, was torn by the tusk of a boar in the abdomen and in the chest, opening into both cavities. The wound in the abdomen commenced an inch below the anterior inferior spinous process of the ilium of the left side, and extended six inches and a half in length, in an oblique direction, to the right side of the scrobiculus cordis, and stomach; the omentum, much of the intestines, and the mesentery protruded, the ileum being torn across, the wound extending an inch into the mesentery; the wounds in the bowel were brought together by four sutures, and the protruded parts were returned, and retained in their proper place, after having been duly cleansed from blood and dirt, by nine sutures in the abdominal parietes. This child, after many very severe symptoms, had nearly recovered, under great care and good management, from both wounds, in three months.

Sir Astley Cooper was the first to include a small opening in the intestine by a ligature passed tightly around it, in the following case:—Joseph Curtis, a butcher, twenty-one years of age, was brought into Guy's Hospital, on the 9th of December, 1808. He had a tumor in his left groin, which was very hard and tense, and gave him considerable uneasiness on pressure. Along with this was violent pain in the stomach, with vomiting of green bilious matter. Various attempts were made at reduction, but they all failed, and the operation was at once determined upon. About four inches of the small intestines were found in the sac, of a dark reddish colour, with the testicle at the lower part. The stricture, situated at the mouth of the sac, was divided in the usual manner; a fluid of a yellowish colour escaped, and on turning up the gut, an opening was discovered, which was immediately laid hold of with a pair of forceps, and tied with a ligature. The parts were then returned, and the abdominal wound secured by five stitches, assisted by adhesive strips. The patient bore the operation well, and seemed much better after it. For the first ten or twelve days, however, his sufferings were severe, but he gradually surmounted them, and was discharged cured, on the 17th of January, 1809, little more than three months after his admission.

Mr. Lawrence,* following the example thus set by Sir Astley Cooper, in operating on a case of strangulated inguinal hernia, in Bartholomew's Hospital, placed a ligature in a similar manner round a small opening, which was discovered just above the part which had been compressed, and which had been probably made by the bistoury, in dividing the stricture. The ends of the ligature were cut close to the knot; a piece of omentum, which had been long protruded, and which it was found difficult to return into the abdomen, was removed by the knife; several vessels were secured in the usual manner; the integuments were brought together by sutures, and the patient was twice bled from the arm. The operation was performed on the 2nd of November, 1826. The sutures were removed from the external wound on the 6th, and came away from the omentum on the 13th, after which the patient rapidly recovered.

In another case, in which the bowel was wounded, Mr. Lawrence adopted the same mode of proceeding; death however followed within two days. The ligature was completely covered by a thin smooth layer of lymph or fibrine, and the small wound in the bowel was closed. This practice has been successfully followed by Professor Gibson, in a similar case to that of Sir Astley Cooper, and it is now pursued by most modern English surgeons, in similar cases of injury of small extent. It must, however, be borne in mind, that the ligature thus applied will be very apt to slip off, unless the opening be very small; and that where it is more than two lines in extent, a simple stitch that will bring the peritoneal surfaces in contact, will, in all probability, be safer.

In 1826, M. Denans, published in the *Recueil de la Société de Médécine de Marseilles*, No. 1, a proposal for uniting the divided ends of a bowel, by the employment of three hollow metallic cylinders—a mode of proceeding which I cannot recommend, and shall not therefore, describe, although it has received the approbation of so able a surgeon as M. Sanson, in the *Dictionnaire de Médécine, et de Chirurgie pratiques*. M. Baudens, in his *Clinique des Plaies d'armes à feu*, p. 338, published in 1836, recommends a metallic ferule, with a ring of gum elastic, which he applies in the following manner:—The elastic ring is to be introduced to the distance of three lines, or a quarter of an inch, within the upper end, the lips of which are immediately inverted, and, consequently, folded over the instrument, which is in the angle resulting from this duplicature; the metallic ring, which is divided in different parts by a deep slit nearly all the way round, is introduced into the lower end of the intestine to the distance of two lines, the wall of the intestine being inverted over it. The two rings thus covered by the inverted gut, are to be brought together, and maintained in apposition by a sufficient number of sutures. These operations are not likely in my opinion, to succeed on persons so prone to inflammatory action and mortification, as the inhabitants of these isles.

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* Lawrence's Treatise on Ruptures, p. 301-3.—1838.

M. Raybord, of Paris, proposed, in a memoir published in 1837, to effect obliteration of the wound, by the introduction of a light, smooth, wooden cylinder, from fifteen to sixteen lines in length, by eight in diameter, through which a ligature, armed with two sewing needles, is to be passed. The cylinder is to be fastened inside the wound by carrying the two needles and ligatures across it, by which its edges are to be approximated; the ligature being secured by the usual knot, the ends are to be twisted and brought out at the lower part of the wound, and retained in that situation. M. Raybord himself proposes to pass the ends of the ligature through the wall of the belly, by means of a crooked needle, for greater security.

In 1822, M. Jobert, whose valuable work I have already alluded to, proposed a method, founded in some degree on that of Ramdohr, which has been employed on man successfully, in at least two instances, and frequently on animals. His first method was to pare the ragged edges of the intestine with a pair of scissors, and then to dissect off the mesentery for several lines, arresting any profuse bleeding by ligatures. Having a ligature prepared, with a moderate sized needle at each end, he introduces one needle from within outwards, in the anterior part of the upper end of the bowel, if he can discover it, and carries it out at the distance of three lines from the cut edge. The needle being brought down and held firmly, the ligature forms a loop; the same process having been repeated on the opposite side of the bowel, it is held steadily by the two loops of the ligature; the surgeon is then to invert or fold in the edge of the lower part of the intestine, like the cuff of a coat, only in the opposite direction, and in this manner place the peritoneal coat inwards. Drawing the upper end of the bowel towards the lower by the loops, he introduces his fore-finger into the inverted end of the lower bowel, and having carried the needle of the first ligature in the anterior part of the bowel along his finger, he pushes it through the inverted end of the lower bowel; and having done the same on the opposite side of the gut with the other needle, he is in a condition to be able to pull the upper bowel into the lower, and thus place the serous surface of the upper part of the bowel, in contact with the inverted serous surface of the lower, the object being to have two serous surfaces opposed to each other. The ligatures having been securely tied, the invaginated bowel is to be retained in contact with the abdominal peritoneum, by attaching the ligatures, twisted together, to the lower edge of the external wound. M. Jobert afterwards suggested the following modification of the operation :—

" Taking care to distinguish the extremities of the divided gut from each other, he traverses the anterior wall of the upper, with a silk thread, armed with two needles. Both needles are then carried to the inferior end, and passed separately through the anterior wall from within outwards, when, by gentle traction, the operator inserts the extremities into each other, to the extent only, however, of from one line and a half to two lines, without any previous introversion of their edges. The needles are then to be given to an assistant; when taking another, which should be exceedingly fine, and armed with a very delicate thread, he plaits the serous membrane of the upper end, and afterwards that of the lower. The ligatures are to be tied with a double knot, in such a manner as to invert the inferior extremity, or turn it in upon itself, and thus bring the serous surfaces in apposition with each other. The ends of the ligatures are left hanging out at the external wound. Three sutures made in this way, are generally sufficient to preserve the relations of the parts."

CASE 26. Professor J. Cloquet in operating on a very large strangulated congenital hernia, accidentally opened the intestine to the extent of an inch and a half. This wound he sewed up, with a common needle and thread, entering it at the distance of four lines, and bringing it out at about one line, from the cut edge, without injuring its mucous coat. Having looped, as it were, the opposite side in a similar manner in two places, he inverted the margins of the wound, and by drawing together and fastening the loops with a double knot, he brought into close apposition the serous or peritoneal surfaces of the intestine. The cut edges being by this proceeding turned into its cavity, the ligatures having been cut off close to the knots, the bowel was returned into the abdomen. This operation was performed on the 13th of July, 1826; and the patient left the hospital cured, on the 12th of the succeeding August.

M. Jobert,* in operating upon a crural hernia, in a lady, having accidentally wounded an intestine, closed the cut by two sutures, introduced in the manner already described; the bowel was then returned into the cavity of the abdomen, the ends of the ligatures being left hanging out. One was withdrawn on the 6th, the other on the 8th day. The external wound was cicatrised in a month.

M. Lembert in 1825, published in the 2nd vol. of the *Répertoire Gênérale d'Anatomie et de Physiologie Pathologique*, a method of closing the divided intestine by suture, without the introduction of an extraneous substance within it, which has been successfully tried on animals and on man. It consists of as many small strong sutures as may be necessary to close the wound, whether longitudinal or transverse, introduced at equal distances, not through the whole substance of the intestine, but through the peritoneal and muscular coats, and fibrous layer external to the mucous coat, so that when the ligatures introduced at about three lines from the cut edges, through both ends or sides of the cut intestine, are brought together, the mucous coat projects into its canal, for a line in width, and the serous coats are retained in direct and flat apposition, under the most favourable circumstances for adhesive union taking place. The knots on the ligatures being tied, the ends are to be cut off, the bowel returned into the abdomen, and the external wound closed. The sutures when successfully applied, cut their way through into the cavity of the gut by the seventh or eighth day, whilst coagulable or plastic lymph, or fibrine, is deposited on the outside of the intestine, including and covering up the ligatures; this becomes a bond of union between the injured and the adjacent textures, adhering generally to the abdominal peritoneum. The first case in which this plan was tried, was under the care of M. J. Cloquet, and is published by M. Jobert, in his work, vol. 1, p. 280; it is considered by him to have been done after his recommendation, and not after that of Lembert; a point of priority of no consequence to the public, and which they must settle between them.

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* Fleury, Archives Generales de Medecine, 3rd Series, Tome 1, p. 297.

M. Lembert, on the 26th of January, 1826, read to the Royal Academy of Medicine, at Paris, another memoir *sur l'Enterographie*, in which, after describing the methods employed before his time, and particularly that of M. Jobert, to which he offers objections, he proceeds to describe his improvement in the following manner :—The number of ligatures must depend on the extent of the wound, each being considered to be about one-third of an inch distant from the other, and all should be introduced before any are tightened. The forefinger being placed within the intestine, and the edge of the cut part being placed on the stretch by an assistant, the surgeon enters the point of the first needle two lines from the cut edge, and penetrates the cavity, or passes it only between the muscular and mucous coats, without entering the cavity of the bowel. Having carried it towards the edge for the distance of a line, the point is to be brought out. A loop is thus, in fact, made in the coats of the intestine, and the same thing is done in the other side of the wound, if it be longitudinal, or in the other end, if it be transverse, by introducing the needle about a line from the cut edge, and bringing it out at the distance of two lines, thus making another loop; the needle on each side thus twice penetrating the wall, or part of the thickness of the bowel. When the two ends of each ligature are drawn together, the looped parts of the intestine meet; and the cut edges, which are free, are readily turned into the cavity of the bowel, thus admitting of the peritoneal surfaces being brought in contact; the free edges above and below, thus inverted, project out into the cavity, forming a ridge or valve. If the intestine be completely divided, a ligature should be placed in the mesentery, close to the gut. One ligature is to be left uncut from the knot, in order to attach the intestine to the wall of the abdomen, and is therefore, to be brought out at the lower end of the wound. It may be remarked, that the disposition for eversion of the mucous membrane over the serous surface, renders the completion of the suture somewhat difficult. This may be, in some degree, obviated, by steadily pushing the mucous coat into the cavity, together with the small piece of the muscular coat attached to it, by means of a blunt probe, when the ligatures are drawn tight.

CASE 27—M. Baudens in his *Clinique des Plaies d'armes á feu*, p. 336, relates the case of a volunteer, wounded by a musket-ball, in 1831, in Algeria, which entered about three inches to the left side of the umbilicus, and passed out behind in a nearly opposite direction. The introduction of the finger enabled M. Baudens to distinguish the wound in the intestine, in consequence, not only, of the opening in it, but of the hardness of the part around it, arising from the contraction of its muscular coat. Having enlarged the wound in the abdomen, he made the patient cough, when the transverse arch of the colon protruded, and presented a large hole with loss of substance, on one side. M. Baudens turned the mucous edges of the wounded intestine inwards, after the method of Lembert, and closed the wound. The patient was freely bled several times, and leeches were applied afterwards, when the patient was removed to Algiers, where the cure was effected, as readily as if the intestine had not been wounded.

As the ball passed out behind, some other parts of the intestine, must in all probability have been wounded, and they must have healed without the assistance of art.

The late Baron Dupuytren[*] proposed, and to which, according to MM. Paillard and Marx, M. Lembert assented, to substitute the continued for the interrupted suture, believing that it was more easily accomplished, and more certainly prevented the escape of the contents of the bowel. He directs that the suture should be begun as near as possible to the mesentery, going either through, or partly through, at the distance of a line and a half from the edge of the wound. The same thing having been done on the opposite end, the edges are to be approximated, and the same operation repeated at equal distances all round to the point where it was commenced; the stitches are then to be tightened by means of a pair of forceps, and the cut edges of the intestine, should they project, should be turned in, by the aid of a probe, until they form a mere line, or seam of the peritoneal coat, the part above being in apposition with the part below. Dupuytren recommended that a loose end of the thread should be left at each end of the seam, which might be brought out and attached, one to each extremity of the wound; or they might be cut off after being tied, and a single thread applied to one of the middle stitches, for the purpose of retaining the intestine near the external wound. This mode of proceeding requires nothing more than a simple needle and thread, for both longitudinal and transverse wounds. It requires no distinction to be made between the upper and lower end of the intestine, no dissection of the mesentery, no preliminary inversion of the cut edges of the intestine, as this is effected by the drawing together and tightening of the stitches.

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[*] Traité theorique et pratique des blessures par armes de guerre, redigé par Paillard et Marx, tome 1, p. 186. Paris, 1834.

The suture recommended by Dr. Gely of Nantes, called the *suture en piqué*, has great analogy with that used by shoemakers, is somewhat difficult of execution, and is liable to the objection, that it causes so much inversion of the edges of the intestine, when completely divided, as to form a sort of diaphragm, obstructing the canal of the bowel, and likely to give rise to serious, if not fatal consequences; especially from the retention of the threads, which were found adhering to the intestine, in all the experiments which were made on animals. It would seem also to require a greater degree of drag upon the sound parts, in order to keep the sides of the wound in apposition, which is a great objection to it in all cases where the opening in the bowel is the result of ulceration or sloughing. Dr. Gely, describes his method in the following words:—a silk thread well waxed, furnished with a needle at each end, rather larger than the thread, is to be passed into the intestine parallel to the wound, about two lines beyond and behind one of its angles, and brought out at the same distance from the wound the other needle performs a similar manœuvre on the opposite side; they are then made to cross each other, as often as may be necessary to close the whole wound; and when the threads of each stitch are tightened by being drawn upon with a pair of forceps, the edges of the cut part are to be turned in, by which means the opening is perfectly closed. Dr. Gely gives one successful case, in which he sewed up in this manner the wound in an intestine, in December, 1841, closing the small external wound by strips of sticking plaster, and a graduated compress and bandage. The patient was bled two hours afterwards. Abundant vomiting took place during the night, but no consecutive accident occurred.

The methods of MM. Lembert and Jobert, have been followed, in France, by others exceedingly ingenious, and by some more or less complicated in their nature, of which Messieurs Amussat and A. Thomson of Paris, Choisy, Béclard, Moreau, Boutard, are the authors.* They do not appear to be as applicable, nor as likely to succeed, as those they were intended to supersede, and I do not therefore refer to them.

M. Jobert, in his last observations on sutures of the intestines, page 545, of the 12th vol. of the *Memoires de l'Academie Royale de Paris*, 1846, sums up his opinion on the value of his own operation, by declaring, that it is very simple, easy of execution, and free from those accidents which attend all other methods of proceeding, for uniting the ends of a bowel which have been completely separated. He affirms, that it is not necessary to separate the mesentery from the ends of the intestine, that it is not necessary to distinguish one end from the other, and that when the cure has been effected, the calibre of the bowel is not diminished. He lays great stress, however, upon the manner in which the ligatures should come away after the operation, or be removed from the re-united intestine. It has been said, that it was formerly known, that a small ligature drawn tightly round a bowel, would cut its way through into the cavity, and pass away without destroying the continuity of the canal. The fact was, however, first explicitly declared by Dr. Thomson, the late learned professor of military surgery, in the University of Edinburgh; and Mr. Travers, in his work to which I have already alluded, rendered it more known throughout Europe. M. Jobert has availed himself of this fact, in a manner which deserves particular notice. He says, that in order to enable the ligature to pass into the cavity, it is necessary that it should have penetrated, in the first instance, entirely through its substance, constituting thereby an essential difference between his operation and that of M. Lembert; who recommends on the contrary, that the ligature should be looped, as it were, through the peritoneal, muscular, and fibrous layers of the intestine, but should not pass through its internal or mucous coat, and penetrate the cavity of the bowel. M. Jobert believes that when the ligature does not penetrate the cavity of the bowel, the part indurates, becomes liable to suppuration, and the thread is separated only to glide into the cavity of the peritoneum. When the ligatures are to penetrate into the cavity of the bowel, he admits of their being cut off close to the knot, or knots, by which they have been affixed. When they are not to penetrate into the cavity, he directs one end of the ligature to be brought out of the external opening of the wound, in order that the surgeon may gently pull upon it, and disengage the suture on the fifth or sixth day, when he thinks the union of the divided bowel has taken place. This he calls the elimination of the ligature, and considers it a very important point to be observed, in the treatment of such cases. He supposes it to be in a great measure proved, in the following instance.

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* A review of them may be read in Vidal, Traitè de Pathologie externe, 2nd ed., tome 4, and in Jobert, Memoires de l'Academie Royale de Médecine, tome xii., Paris, 1846.

M. Dieffenbach,[*] in operating on a case of strangulated hernia, cut off three inches of the bowel, and re-united the divided ends by an interrupted suture; this he passed through the outer wall of the intestine, without touching its internal, or mucous coat, which, on the end of the intestine being drawn together, was rolled inwards in the form of a ledge, or ring. The patient recovered, and remained well for several weeks, when he died of an attack, apparently of internal strangulation of the bowels. This was found on examination after death, to be in a different part from that on which the operation had been performed. On the right side of the pelvis, several folds of intestine were found adhering to the crural arch. On attempting to separate these adhesions, a small purulent depôt was opened into, containing a loop of silk. M. Dieffenbach having laid open the intestine, found the upper extremity united to the lower by a cicatrix, interrupted in two places by two suppurating points, to which two ligatures were still adhering, and hanging into the cavity of the gut.

According to the ideas entertained in England on this subject, the safety of the patient in a case of this kind, would have depended on the deposition of such a quantity of coagulable or plastic lymph, or fibrine, as would have completely included, or encased the ligature within it, giving rise at the same time to adhesion to the neighbouring parts, and often to the peritoneum of the abdominal wall. The separation of the ligature, and its falling into the cavity of the peritoneum, would be attributed to the failure of the adhesive process by the deposition of lymph, in consequence of the inflammation having too rapidly passed beyond that stage, into the more active one, which destroyed the patient.

Dr. Gross made twenty-three experiments upon animals, with great care, in illustration of the original method of Lembert by the interrupted suture, and he sums up his report in the following words:—"The experiments terminated favourably in nineteen cases out of twenty-three, notwithstanding the wounds in some of them were of unusual extent." In three, death was produced by peritoneal inflammation, from the escape of fæcal matter; in the other, the animal perished without any obvious, or assignable cause. In three of the cases, the wound was transverse; in the other, longitudinal. In the latter, experiment eleven, it was three inches and a half in length, and closed by eleven sutures; death occurred on the thirteenth day, from extravasation of fæcal matter, occasioned by the imperfect union of the edges of the incision at its upper angle. All the sutures, except two, had disappeared; the wound was scarcely more than two inches long, and the reparation had been effected, mainly through the intervention of an adjacent fold of the small intestine. The calibre of the tube was of the natural size, in nearly all the cases in which the parts were examined after death. In a considerable number of them, the consolidation of the wound was remarkably perfect, even at a very early period after the experiment, much more so, indeed, than after the use of the continued or interrupted suture.

Dr. Gross, with respect to the whole of his experiments, sums up with the following observations:—"The results are eminently favourable to its use on the continuous suture, as not one proved fatal, although the wounds in several were of extraordinary length.[*] In eight the needle was carried through the whole thickness of the bowel, and in five, the everted mucous membrane was pared off on a level with the surrounding surface; in eight, the suture was introduced through the fibrous lamella, or between the muscular and mucous coats; and in one, through all the layers of the tube, except the peritoneal.

It is worthy of remark, that the calibre of the tube was not sensibly diminished by the operation in any of the experiments.

Of the four methods, that of introducing the suture through the cellular fibrous lamella is the least objectionable, as it enables us to bring the serous surfaces into more accurate apposition. When the needle is conveyed through all the tunics, there must necessarily be some degree of puckering, whereby the mucous lining will be forced between the lips of the wound, if not beyond the level of the peritoneal membrane. By such an arrangement, the adhesive process would be retarded, and if the stitches were to lose their hold, or if the bowel should not become glued to the neighbouring parts, fœcal effusion might occur, followed by its whole train of evil consequences.

In making the continued suture, I would, therefore, recommend, that the needle be carried through the cellular fibrous lamella, or between the muscular and mucous membranes, and not across all the tunics, as is generally advised by authors. The lips of the wound should be held parallel with each other during the operation, and the stitches, drawn with considerable firmness, should not be more than a line, or at farthest, the eight of an inch apart. The needle is to be introduced a short distance, say, half a line, from the peritoneal edge of the opening,[†] and brought out at the corresponding point at the opposite side. The first stitch should be one line from one angle of the wound, and the last about the same distance from the other, care being taken to secure each with a double knot, and to cut off the extremities of the suture close to the surface of the tube. The instrument which I prefer, and which I employed in nearly all my experiments, is a long slender sewing needle, armed with a waxed, but strong and delicate silk thread. The operation should be performed as expeditiously as is consistent with safety, and the bowel handled in the gentlest possible manner."

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[*] Archives de Médécine, tome 13, page 314.

[*] It is proper to state, that three of the animals were killed too soon after the operation, to render it at all certain, that they would have recovered from its effects.

[†] It should be recollected, that in wounds of the bowels there is always. considerable retraction of this membrane, by which the other tunics are exposed. Hence if the needle be introduced half a line behind the peritoneal edge of the opening, as recommended in the text, it will be at least the eighth of an inch from the mucous margin, and this will afford the surgeon a sufficient amount of substance to prevent laceration, or breaking away of the stitches.

Mr. Travers, says, p. 188:—"Let a small round sewing needle, armed with a silk thread, be passed near to the lines formed at the bases of the reverted lips. The thread is to be carried, at short, regular distances, through the whole extent of the wound, the operator being mindful, that an equal portion of the edges is included in each stitch. When the suture is finished, let the thread be securely fastened, and cut close to the knot. The reduction of the prolapsed fold should then be conducted with the nicest caution; and when completed, the wound of the integuments should be treated with a stitch, a plaister, or a poultice, as circumstances dictate."

M. Hippolyte Nuncianti, Professor of Anatomy at Naples, has invented a mode of proceeding denominated *the spiral suture*, which he considers to possess the advantages of acting so gently on the wall of the intestine, as not to give rise to undue inflammation, and with such precision as will insure the permanent approximation of the divided extremities of the bowel. The method of M. Nuncianti seems to be neither more nor less than the common continuous suture, made with an ordinary needle and a waxed silk ligature, begun on the inside, close to one end of the incision, and brought out on the peritoneal surface about a line distant from where it entered, the end of the ligature being left hanging out instead of being fastened with a knot. The needle is then to be carried to the opposite side through the bowel, in a similar manner, from without inwards, and the sewing continued from right to left, and from left to right, until completed. The two long, or hanging ends of the ligature, are to be then gently drawn upon, so as to tighten the stitches, and to turn in the edges of the wound, the two peritoneal surfaces being thus opposed to each other, back to back. The suture should be commenced on one side of the cut bowel, and should terminate on the other, so that the two threads may be opposed to each other when drawn upon, and the inversion of the edges made more easy of accomplishment, when the ends are duly fastened and cut of. M. Nuncianti has performed this operation three times on the human subject, with success.

CASE 28.—A tailor, twenty-three years of age, being in the country, shooting, suffered from strangulated hernia, and the bowel was injured in the rude attempts made to return it. When operated upon at the hospital, the bowel was found to have been torn for nearly the length of an inch. It was sewn up by M. Nuncianti according to his method, and the patient was discharged cured on the fortieth day, the ligature having come away internally on the seventeenth day.

CASE 29. — A young surgeon, operating for hernia on a lady thirty-six years of age, had the misfortune to make a cut in the small intestine, of nearly an inch in length. M. Nuncianti sewed it up, and the lady was cured on the forty-fifth day, the ligature coming away on the thirteenth.

CASE 30.—M. Nuncianti, operating on a man for strangulated hernia, found a slough on the anterior part of the intestine, eight or ten lines in extent, which was torn by the simple pressure of the finger; the rent was immediately sewn up, and the man was cured on the fortieth day, the ligature coming away internally on the fifteenth.

The continuous sutures of Bertrandi, of Mr. Travers, of Dupuytren, of M. Lembert, of M. Jobert, of Dr. Gross, and of M. Nuncianti, appear to resemble each other so much as to be essentially alike; the object of all being to close the bowel effectually. The later writers have attended more than their predecessors, to turning the cut edges of the intestine inwards, so as to bring the serous surfaces external to the cut edges in contact, when the ligatures are duly tightened—an important addition to the operative process. It remains to be proved, from observations and from trials made on man, whether the mode of proceeding which refrains from passing the needle and thread through the inner or mucous membrane, or that which effects this object, is the best. I am of opinion that the continued suture through all the coats of the intestine is the best; and shall continue to think so until it shall be proved that the ligature passes into the bowel in both methods; a result which is doubted, when the inner membrane remains intact.

The simplest method of making the continuous suture seems to be that which M. Nuncianti has recommended, unless it shall be found from experience, and which I apprehend will be the case, that, instead of leaving both ends of the thread long, a knot may be made on the end first inserted from within, as is done in ordinary cases; and again on the last stitch required to close the wound, which last knot may be made sufficiently firm by a turn of the thread over the needle, when the thread may be cut off close to the bowel. The stitches should not be tightened when made, but left loose until all are inserted, when they may be drawn close, one after the other, the cut edges being turned in by a probe, so that the peritoneal surfaces may be in contact under the stitches, the divided edges being turned into the cavity of the bowel. Each stitch should be about two lines, or the sixth part of an inch asunder; and at the same distance from the edge of the wound. They must not be drawn too tightly, or they will cause the intestine to pucker, or form a ridge on the outside instead of a flat surface, the ridge or valve being within. A common needle and a waxed silk thread seem to answer very well in this operation, which should be practised frequently on the dead bodies of animals, and on man.

The first of the following cases, by Dr. Brigham, of the New York Lunatic Asylum, is very interesting, as showing what nature can sometimes do, when not interfered with by art; the other, by Mr. Jenkins, of Gosport, what she sometimes will do, when she is duly assisted by it.

Case 31. A lady, out of her mind, made two cuts into her abdomen, with a pair of scissors, one about an inch and a half above the umbilicus, the other half an inch below. From the upper wound, she took out and cut off, seventeen inches of small intestine, weighing one ounce and one drachm, and one ounce and two drachms of omentum. One end of the intestine was withdrawn into the abdomen, and the other was returned, without hope of recovery, the wounds being closed by stitches and bandage. Injections of broth and laudanum were administered, and she was kept perfectly quiet. Thirty-three days after the accident, she had a small discharge from the bowels, and the next day a copious one; and gradually recovered.

This lady died six months afterwards, without any remarkable symptoms of disease, beyond those of general failure of health. The peritoneum, in the region of the wound, was highly congested, thickened, and adhered to the intestines. The portion of intestine removed, was the colon, not the small intestine, as supposed, four inches from the entrance of which it was divided; the separated ends were drawn together at the place of injury, and united by organized lymph, which also connected them to the walls of the abdomen. The passage between the divided ends was small, and crossed by a fine ligamentous-like band, but still large enough to permit the passage of semi-liquid fæces.

Case 32.—Richard Cain, a sailor, attempted to destroy himself, Dec, 29th, 1818, by cutting open his belly with a razor. I found him on a bed, with an oblique incised wound on the right side of the abdomen, about three inches in length, with the open extremities of two portions of intestine pouring out fæcal matter, and protruding from the wound. A piece of intestine was lying upon the floor, which on examination, proved to be a part of the colon, about two inches and a half in length. The patient had lost much blood, was vomiting, and had a scarcely perceptible pulse. His extremities were cold, and he had a countenance indicating immediate dissolution. Having administered a little brandy and water, &c., I proceeded to bring the two portions of wounded intestine together, being ably assisted by Mr. Radcliffe (now of 51, Strand), by a continued suture carried round the whole cylinder of the gut, so as to bring the edges into contact throughout the circumference. After this, I attempted to return the parts into the cavity of the abdomen, in which operation I experienced some little difficulty, from the quantity of matter to be replaced, including the omentum and mesentery; but by gentle continued pressure, the object was attained, and having with my finger ascertained that the parts were liberated from constriction, I brought the edges of the wound of the parietes of the abdomen together, by means of adhesive plaster, compress, and bandage, and left the patient with injunctions that he should take only gruel or tea.

Vespere.—Some signs of reaction have taken place, and he now complains of pain of the abdomen, with frequent vomiting and singultus, the surface being restored to nearly its natural temperature; pulse small, weak, and contracted.

Visit horâ xi. nocte.—Increased heat of surface, with continuance of pain of abdomen, which is general, the other symptoms remaining as in the evening.—Venæsectio ad deliquium. The abdomen to be fomented frequently during the night.

30th.—Some degree of tenderness upon pressure of the abdomen, with slight tension; thinks the pain not increased; occasional vomiting, but not so frequent as yesterday; hiccough troublesome and frequent; had no motion for two days previous to the wound. From the very wretched garret in which the patient was placed, without any fire-place in it, or person to attend him carefully, I was under the necessity of having him removed to the Infirmary of the House of Industry, at Alverstoke, a distance of more than a mile from his lodging; this was effected by means of a hand-barrow, under the anxious superintendence of Mr. Radcliffe. Upon my visit at the infirmary soon after his arrival, I found the dressings loosened, the wound of the abdomen open, and a large portion of small intestine protruding from it, a part of it having been deprived of its peritoneal coat by the edge of the razor, at the time I conclude of making the first incision into the cavity of the abdomen. Having returned the intestine, I considered it prudent to insert ligatures to bring the edges of the external wound into contact, aided by compress and bandage. Was blooded and had a common enema; gruel, and arrow-root.

Vespere, horâ 7.—Pain of abdomen less; has not vomited since three, p.m.; hiccough continues, but less frequent; injection had no effect. Repet. Inject. et adde Magnes. Sulph.

31st.—Passed a restless night from continuance of pain of the abdomen, with slight tension and tenderness upon pressure; vomiting and hiccough continue; skin hot; tongue coated; pulse small and contracted. The bleeding repeated; ol Ricini, ℥ss. statim, and an injection.

Jan. 1, 1819.—Pain and tenderness of the abdomen are increased with continuance of singultus; castor oil remained in his stomach, but the injection returned without effect. The bleeding and the castor oil to be repeated; the enema to be administered every four hours.

Vespere, horâ 8.—Has had three copious motions, finds himself much relieved since; belly less tender; tension decreased; pulse 98, and soft; no vomiting since the motions; complains much of want of sleep. ℞ Tinct. opii. M. xxx. aq. menth. pip. ℥i. misce fiat haustus, horâ somni sumendus.

2.—Passed a better night, but without sleep; pain of abdomen very slight; tenderness and tension less; singultus continues occasionally; skin nearly natural in temperature; no evacuation since yesterday; dressed the wound, which looks well; complains most of want of sleep.

3.—Is said by the nurse to have had three hours' sleep during the early part of the night; no tension, or pain of abdomen, except upon pressure, and then but slight; is said to have vomited twice during the night; no evacuation since the 1st. The injections to be repeated every four hours, until they operate; and, in the event of their not producing evacuations, after the second, to take the castor oil draught, as before.

4.—Passed the night without pain, and continues free; had three evacuations from the injections and castor oil; tenderness upon pressure very slight; no return of vomiting; hiccough continues. Repet. inject. vespere.

5.—The only unpleasant symptom to-day is the continuance of singultus, but the patient is improved in his appearance; complains of great debility, and is anxious to be allowed food.—To be allowed weak mutton-broth for dinner, with bread sopped in it; the injection at night.

6.—Continues to mend; wound of abdomen to be dressed; union taking place, ligatures removed.

7.—Has had no hiccough for the last twenty-four hours; is improving; complains of extreme languor.—To be allowed milk, with bread boiled in it, and sago at night, in addition to mutton-broth. The enema at night.

8 and 9.—Wound dressed; it appears to be nearly healed.

12.—No material change in the patient, but upon dressing the wound, it looked unhealthy.

13.—There is some slight irritable inflammatory redness, with an unhealthy aspect about the wound of the abdomen, but without pain.

15.—This morning, a discharge took place of about nine ounces of thin pus, of an offensive character, which seems to have formed between the integument and the abdominal muscles, and not to have extended deeper.—To be allowed bread and butter, with a glass of negus at night.—The wound to be simply dressed; the injection to be repeated.

16.—Thinks himself better; wound looking more healthy; pus of a better character; is in all other respects doing well; to be allowed chicken for dinner.

17.—Much improved; offensive odour from the wound continues.

18, 19, 20.—Continues to improve.

21.—Dressing this day seems to be tinged with bile; the wound to be kept open.

23.—Debility very great; to be allowed mutton and beer for dinner.

30.—From this time, the patient gradually improved; the ulcer healed; and the patient left the hospital two months after, by running away, fearing his pension would be stopped to pay for his expenses. Upon enquiry at the pay-office, I find that he continued to receive his pension eighteen months after the date of his departure.

J. Jenkins, Gosport.

There is a much greater degree of danger attendant on wounds of the small intestines, than of the large ones: that is, recoveries more frequently follow wounds of the colon in its various parts, and of the rectum, than of the jejunum or ileum. It is not however easy to form a valid prognosis in any, even the simplest of such cases, as success depends on many causes, over which the surgeon has no control, and which he cannot foresee.

The Baron Percy relates three cases in support of this opinion, in which two musket balls passed through the colon, the patient recovering without much suffering or inconvenience. In the third, a Dutch soldier, wounded at Raucoux, by a ball, which entered on the right side, midway between the navel and the anterior superior spinous process of the ilium, passing through that bone, some oil of almonds taken the next day, came through the anterior wound, which was as usual dilated. Five days afterwards some omentum protruded with intestine, which he was careful not to return. The wound was dressed several times a day, and at the end of ten days the omentum sloughed off, the intestine was gradually withdrawn, the wound diminished, the discharge gradually ceased, and the patient recovered. An example, the Baron says, of what may be expected from nature when assisted by art. It might be said, that art did little, and that little wrongly.

# LECTURE III.

*Treatment of punctured wounds; When the external wound is not larger than half an inch, no attempt should be made to probe, or interfere, for the purpose of examining the intestine; When the external wound is larger, it should not be enlarged, unless the intestine protrude, or its contents be discharged through it; If symptoms of effusion from the bowel, or of extravasation of blood occur, the wound must be enlarged, and the bowel or artery secured; The wound must be re-opened, if the symptoms afterwards continue, and there be a decided swelling beneath the wound; Baron Larrey's cases; Dr. Cheston's case of removal of four inches of mortified intestine, the divided ends being brought together, and afterwards requiring to be separated, and brought out externally; General directions for the treatment of wounded intestines; Treatment of hemorrhage within the abdomen, following a penetrating wound; The wound should be enlarged, and the injured artery tied; Cases; Ravaton's cases of wounds of the vena cava and aorta; Dr. Sherman's case of wound of one of the mesenteric arteries; Penetrating wounds of the abdomen, from a musket ball; Cases; Cases of musket-ball wounds of the abdomen, with injury of the intestine; Cases in which the musket-ball was passed per anum; Case in which the ball was passed per anum, and afterwards a portion of the waist-band of the breeches; Lodging of the ball, followed by its encasement with a layer of coagulable lymph; Dr. Cox's case of wound of the intestine, the ball passing per anum.*

When an incised wound in the intestines is not supposed to exceed a puncture in size, or the third of an inch in length, no interference should take place, for the nature and extent of the injury cannot always be ascertained, without the committal of a greater mischief than the injury itself. When the wound in the external part is made by an instrument not larger than one-third, or from that to half an inch in width, no attempt to probe, or to meddle with the wound, for the purpose of examining the intestine, should be permitted. When the external wound is made by a somewhat broader and longer instrument, it does not necessarily follow that the intestine should be wounded to an equal extent; and, unless it protrude, or the contents of the bowel be discharged through the wound in the first instance, the surgeon will not be warranted in enlarging the wound, to see what mischief has been done. For, although it may be argued that a wound four or more inches long, has been proved to be oftentimes as little dangerous as a wound of one inch in length, most people would prefer having the smaller wound, unless it could be believed, from calculation, that the intestine was also injured to a considerable extent. Few surgeons even then, would like to enlarge the wound, to ascertain the fact, unless some considerable bleeding, or a discharge of fœcal matter, pointed out the necessity for such operation; when there would be reason for believing, that the patient would have a better chance of recovery after the application of a suture to the wounded artery or bowel, than if it were left to nature.

If the first two or three hours have passed away, and the pain and the firm not tympanitic swelling in the belly, as well as the discharge from the wound, indicate the commencement of effusion from the bowel, or an extravasation of blood, an enlargement of the opening alone can save the life of the patient, although the operation may probably be unsuccessful. It is not, however, on that account to be always laid aside, when the state of the patient offers even a chance of success. The external wound should be enlarged, the effused matter sponged up with a soft moist sponge, and the bowel or artery secured by suture. When a penetrating wound, which may have injured the intestine, has been closed by suture, and does not do well, increasing symptoms of the inflammation of the abdominal cavity being accompanied by general tenderness of that part, and a decided swelling underneath the wound, indicating effusion beneath, and apparently confined to it, the best chance for life will be given by re-opening the wound, and even augmenting it, if necessary, to such extent as will allow a ready evacuation of the contents of the bowel. It is a point in surgery, which a surgeon should contemplate in all its bearings. The proceeding is simple, little dangerous, and under such circumstances, can do no harm. I have seen instances in which it has been done, and others in which it might have been done with some hope of its being beneficial; and I recommend it for the serious consideration of those who may hereafter have the management of such cases.

Case 24, page 16, is highly illustrative of this point, and the following cases corroborate and confirm the directions given in the strongest manner:—

Baron Larrey, in the 2nd vol. of his *Cli-*

*nique Chirurgicale*, p. 392, relates the case of a soldier, wounded by a sword, on the 27th of April, 1820, to the extent of a half an inch, transversely across the right inferior part of the abdomen, through which the small intestine protruded, with a wound in it, giving passage to the contents of the bowel. This M. Carré sewed up, with a needle and thread borrowed from a bystander, restored it to the cavity of the belly, and sent the man to the Hospital of the Guard in Paris. The Baron next day enlarged the wound evacuated from the cavity of the belly a quantity of blood, and then saw *several* (*plusieurs*) convolutions of the intestine, which had already contracted adhesions one with the other. He did not think it right to search for the wounded intestine, but contented himself with evacuating the blood effused in the species of pouch or reservoir thus formed, and dressed the wound simply. The symptoms were not diminished by this treatment; the nausea and vomiting continued, accompanied at short intervals by colicky pains, and bloody evacuations; the pulse was small and quiet; the countenance pale; eyes dull and watery, and the extremities cold. Cupping glasses were applied, and the scarificator with sharp points (*ventouses mouchetés*) was then used all over the belly, which gave great relief, and was followed by several bilious bloody evacuations. The symptoms having returned the next day, they were relieved by the same remedies, accompanied by emollient embrocations and lavements, iced drinks given by the teaspoonsful, sedatives and mild purgatives, and subsequently a blister to the abdomen. On the thirteenth day, the parotid gland on each side was attacked by critical inflammation and abscess, which appeared to remove the abdominal symptoms; and on the fifteenth, a piece of thread six inches and a half long was extracted from the wound; the man went out of hospital cured on the seventeenth day after the accident.

The Baron supposes "that the adhesions he had seen between the intestines separated spontaneously, that the sewed up intestine lost its adhesions in a similar manner, and became loose and floating in the cavity, as well as the other small intestines implicated by the wound and its consequences." He admits that the cure was greatly aided by the suture in the intestine, and by the mode of making it, and says the man was shown to the Society of Medicine, as a remarkable and fortunate case.

In a case he relates, in succession, of another soldier injured by accident, on the 6th of June, 1829, the bayonet, which entered below, and a little to the left, of the epigastrium, made a wound an inch long, and nearly two inches distant from the linea alba, and came out behind, on the opposite or right flank, just above the posterior superior spinous process of the ilium. A piece of the small intestine protruded through the anterior opening, which his regimental surgeon closed by suture, before he sent him to the hospital, where he arrived, labouring under the usual symptoms of imminent danger.

The next morning Baron Larrey finding the belly distended with air and very painful, and the stitches of the suture quite upon the stretch, whilst a bloody fluid flowed out by the side of one of them, decided upon taking them out; after which he enlarged the wound upwards and downwards, and allowed a considerable quantity of blackish-coloured blood, which had been evidently effused into the cavity of the belly, to escape; its evacuation was aided by means of a gum elastic catheter, carefully introduced at the lowest part of the wound. The pointed cupping scarificators were frequently applied, together with a good number of leeches, and the other usual remedies, for the first nine days of difficulty and danger. On the tenth day the motions became copious, bilious, and bloody, and the dangerous symptoms disappeared until the twenty-first day, when they returned, and were overcome by the same means as had been formerly employed. He was eventually cured by the sixty-first day.

Sir Astley Cooper, in that part of his work which relates to crural and umbilical hernia, mentions a case, communicated by Dr. Cheston, of Gloucester, in which four inches of mortified intestine having been removed, the cut edges of the bowel were stitched together, and two sutures were passed through the mesentery, on each side of the divided intestine. The case proceeding badly, Mr. Naylor, the operator, thought it necessary to remove the stitches on the intestine, bringing its open edges without the edges of the wound. In the course of the night, when the patient appeared almost expiring, a sudden and violent discharge of air and fæces burst forth in immense quantity, to his immediate relief; after which he gradually recovered, until the tenth day, when Mr. Naylor again brought the extremities together by suture, the operation failing in consequence of the stitches giving way. After a time, it was found that a truss almost entirely prevented the escape of the contents of the bowel. Sir A. Cooper mentions two other unsuccessful cases.

When then the wounded bowel protrudes, or the external opening is sufficiently large, or nearly so, to enable the surgeon to see or feel the injury by the introduction of his finger, there can be no difficulty as to the mode of proceeding, if the following principles are borne in mind:—

A puncture, or cut, which is filled up by the mucous coat, so as to be apparently impervious to air, does not demand a ligature.

An opening which does not appear to be so well filled up, as to prevent air and fluids from passing through it, as such wound cannot usually be less than two lines in length, should be treated by suture. The question is as to the best manner of applying it. When the opening is small, a tenaculum may be pushed through both the cut edges, and a small silk ligature passed around, below the tenaculum, so as to include the opening in a circle, a mode of proceeding I have adopted, from analogy, with success, in the internal jugular vein, without impairing its continuity; or the opening may be closed by one, two, or more continuous stitches, made with a very fine needle and silk thread, cut off in both methods close to the bowel, the removal of which from the immediate vicinity of the external wound is little to be apprehended, under favourable circumstances. The threads, or sutures will be carried into the cavity of the bowel, as has been already stated, if the person survive; and the external part of the wound will either adhere to the abdominal peritoneum, or to one or other of the neighbouring parts.

When the intestine is more largely injured, in a longitudinal or transverse direction, or is completely divided as far as, or beyond the mesentery, the employment of the continuous suture is to be preferred to all others. It appears to merit the preference thus awarded to it, not only from its use in man, but from the experiments which have been made on animals, to which I have alluded in the second lecture.

When the abdomen is penetrated, and considerable bleeding takes place, and continues externally, it is necessary to look for the wounded vessel. When the hæmorrhage comes from one of the mesenteric arteries, or the epigastric, the wound is to be enlarged, until the bleeding artery is exposed, when ligatures are to be placed on its divided ends, if they both bleed. I have seen this vessel tied several times with success.

Case 33.—A Portuguese caçador on picquet, was wounded at the second siege of Badajos, in a sally made by some French cavalry. He had three or four trifling cuts on the head and shoulders and one across the lower part of the belly, on the right side. He bled profusely, and when brought to me had lost a considerable quantity of blood, which came through a small wound made by the point of a sabre. This wound I enlarged, until the wounded but undivided artery became visible; upon this two ligatures were placed, and the external wound was sewed up. The peritoneum was opened to a small extent, but the bowel did not protrude, and the patient (not being an Englishman) recovered after being sent to Elvas.

Case 34.—A soldier, of the same regiment, cut down at the same time, died as soon as he was brought into camp, having been severely wounded in the chest and the abdomen. He was said to have died from hæmorrhage, from a wound in the belly, two inches in length, made by one of the long-pointed swords of the French dragoons. I had the curiosity to enlarge the wound to the extent of several inches, and found one of the small intestines had been cut half across, another part injured, and that the blood had come from an artery which had been opened by the point of the sword in going through the mesentery.

The recollection of these and of other cases has always induced me, in my lectures, to say that when hæmorrhage takes place from within the abdomen, the wound should be enlarged; and that if an artery in the mesentery, or in any other place which can be got at, should be found bleeding, a very fine silk ligature should be placed, if possible, on each of its divided extremities, and cut off close to the knot; the external wound being afterwards accurately closed.

Ravaton relates, in his two hundred and forty-third observation, the case of a soldier, wounded by a sword, which entered the abdomen, and passed between the viscera without injuring any of them, until it opened the vena cava, the bleeding from which filled the cavity, and caused his immediate death. In his two hundred and forty-fourth observation, in a similar injury in a gentleman, the aorta and vena cava were both opened, without any other internal part being discovered to be hurt.

Case 35.—Dr. Sherman, of Rotherham, was called on the 1st April, 1841, to James Riley, who had been stabbed in the abdomen with a large pocket knife. The wound, six inches in length, of a crescentic form, across the lower part of the left side of the belly, allowed a large quantity of intestine to protrude, enough it was supposed to fill a wash-hand basin. One of the mesenteric arteries had been wounded, and bled profusely; the man was exhausted. The parts having been gently cleansed, the artery was tied, and the bowels returned. Several stitches were introduced through the muscles, and close together, to bring the divided parts in apposition, with the aid of adhesive plaster and bandage. He was kept quiet in bed, with the abdominal muscles relaxed; his bowels were moved by injections, and he was bled when reaction took place. He perfectly recovered in about six weeks.

When a musket-ball penetrates the cavity of the belly, it may pass across in any direction, without injuring the intestines or solid viscera. It usually does injure one or the other, and it has been known to lodge without doing much mischief. The symptoms are usually indicated by the parts injured, although in all the general depression and anxiety are remarkable, and their continuance sometimes marks the extent of mischief.

The following cases of the survivors of hundreds who died under similar wounds, during the war beginning with the battle of Roliça, in Portugal, in August, in 1808, and ending with that of Waterloo, in June, 1815, may be read with a melancholy interest, as shewing what sometimes will happen in a few rare instances; and, even then, as more dependent on the wantonness of nature, than on the united efforts of science and of art.

Case 36.—A soldier of the brigade of heavy cavalry, under General Le Marchant, advancing in line to charge the French infantry, at Salamanca—on which occasion the General was killed—was struck by a musket-ball, which entered in front, between the umbilicus and ilium of the left side, and came out behind on the opposite side, above the right haunch-bone, thus traversing the body. The bowel protruded in front, but was uninjured, and was easily restored to its place. He remained at the field hospital with me for the first three days, and was rigorously treated, as well as afterwards in the San Domingo Hospital, where he gradually recovered, and was ultimately sent to the rear.

Case 37.—Dr. Hennen has related, in his work, the case of a soldier of the Brunswick corps, who was wounded at Quatre-bras, on the 16th of June, by a grape-shot, which destroyed the elbow-joint, rendering amputation necessary, and passed across the anterior part of the abdomen, without injuring the bowels, a portion of which protruded at each opening. The patient was brought to the hospital at Brussels, on the 19th, with moderate fever, and very little pain in the abdomen, the functions of the intestinal canal not being disturbed. He did not take any medicine, and lived on light broths. The wound healed slowly, and cicatrized in the course of three months, leaving only some uneasiness behind during a change of weather, or when any irregularity of diet was committed.

This case interested me greatly during the time I spent at Brussels after the battle of Waterloo; principally from the absence of all peritoneal inflammation, that was not actually necessary for his cure, and from the freedom with which the functions of the bowels were performed, indicative of their substance not having participated in the injury.

Case 38.—A soldier, of the fusilier brigade, was wounded on the heights of Saca Parté, in 1811, in front of Sabugal, by a small musket ball, which entered a little below the umbilicus, and to the side of the linea alba, and made its exit at a corresponding spot behind, near the spine. The wound was dressed simply, and the man was carried the next day to Sabugal, where he was bled, and almost starved. The symptoms which ensued were of little comparative moment. The bowels were gently opened by castor oil; no blood was known to pass, and he gradually recovered; although he was sent to the rear, and did not rejoin his regiment.

In this case, and in others of a similar nature, it does not follow that the bowels were not injured. The part injured, even if its life were destroyed, may be attached by the adhesive inflammation surrounding it, to the adjacent ones which are sound; and the slough when detached, drops into the cavity of the bowel. The only difficulty is, in comprehending why it happens that so little inflammation is excited in some cases of most serious injury, and so much in others, apparently of little moment.

Case 39. Lieut. Slayter Smith, of the 13th Dragoons, being engaged at Campo Mayor, on the 25th March, 1811, with a much superior force of French cavalry, was shot by a pistol ball, in the rear, by a Hussar of the 16th regiment, whilst engaged with one of the 26th Dragoons. It entered at the left hip, three inches and a half from the junction of the ilium with the sacrum, and an inch and a half below its crest, and came out about three inches below the navel, and one inch to its right side. He felt a terrible shock, but did not faint or fall from his horse; on being relieved from his two antagonists, he dismounted, and became aware of the injury he had sustained, which he thus describes:—

"There was a protrusion of bowel from the wound in front, of about three inches; but little blood issued from it. The hemorrhage from the wound in my back was very copious. I was obliged instantly to remount, as a French squadron followed up our rear, and a French officer, with three or four of his men, were so near me, that he called out 'Rendez vous, mon officier;' to which I replied 'Pas encore, Monsieur,' and got away. I had not time to do more than pull up my overalls, therefore they remained open, my shirt flying about; so that I was compelled to hold the protrusion, and keep it in as much as I could with one hand; but it had now lengthened to six inches, and I felt so disgusted with having it in my naked hand, that I wrapped it up in my shirt.

"I reached the field hospital shortly afterwards, when the protrusion was returned without enlarging the orifice, and *no* stitch was put into the wound, then or afterwards. It was dressed merely with lint and adhesive plaster.

"I was carried on a bearer to Campo Mayor, where Marshal Beresford kindly took me into his quarters, and where I begged earnestly for a glass of Madeira, which, after a little hesitation on the part of the surgeon, was given to me. But they afterwards thought it necessary to bleed me; but little blood followed the insertion of the lancet. This was the *only* time I was bled.

"Soon after, I felt as if I were dying. My breathing became short and oppressive, and a strange sensation came over me, which was relieved by a most violent sickness. I slept pretty comfortably and quietly that night. In the morning, I found the bed saturated with blood, which had trickled through to the floor, and had escaped from the wound behind.

"My diet was for some time very sparing, consisting of tea, dry toast, and light pudding. Previously to being wounded, I had eaten little or nothing for twenty-four hours, which probably saved my life. I had no motion for two days, and a glyster was administered, which had the desired effect in a partial degree; and as no blood came away, or followed, the surgeons were satisfied that my bowels were also safe.

"Before a month had elapsed, I and all the wounded were removed to Elvas, in *bullock-cars*, and a desperate journey it was.

"On my arrival, inflammation began in the wound in front, accompanied with great swelling and pain. The swelling was laid open, and a quantity of matter was evacuated, followed by an angry-looking protrusion, which was carefully washed with warm water, and poulticed; and, when the inflammation had subsided, was dressed as before, with lint, confined by adhesive plaster. When the protrusion was touched by the hand, I again experienced that nauseous and disgusting sensation I have already alluded to, and to which, in comparison, the application of the knife or lancet was a flea-bite.

"The protrusion gradually receded, the inflammation abated, and the skin healed, till which ime my diet was very low indeed; but after which I was gradually allowed to take meat, and ine *thoroughly* diluted with water.

"At the end of May, I travelled in a hired car iage, by slow journeys, to Lisbon, and embarked the *Audacious*, 74, for England; wearing, by e advice of the surgeons, a broad belt as a upport, which has since been superseded by an lastic belt and a defence, which have been ost efficacious, and were approved of by you. arrived in England in June, and in September as recommended to try Brighton for change of r, where I placed myself under the care of Sir atthew Tierney. Soon after, I felt terrible pains the *right* side of my back, in a line with the ound, through the ilium, or rather above it, here a kind of tumour or excrescence formed, d which worked and moved like a mole under round. Sir Matthew pronounced it to be someing carried in by the ball, but postponed openg it till it attained a more favorable situaon. For several days I suffered agony from it, d one night on retiring to bed the pain was so eat, that I perspired amazingly, which in some easure I thought relieved me. Completely orn out, I fell into a long and deep sleep, and waking late in the morning I found all pain and xcrescence gone, and nothing remaining but a enderness of the parts on pressure of the finger. underwent much from violent spasms in the stomach, which I never had before I was wounded. I recovered, however, sufficiently to rejoin my regiment the following spring, in the Peninsula, and was soon afterwards again wounded in a skirmish, by a spent shot, in the left shoulder, which, however, was of no moment; though I was compelled to return to England on sick leave, in October, 1812, as the spasms increased with greater severity, incapacitating me from doing my duty, and at times rendering me totally helpless.

"I may as well mention here that I had a sabre cut on my head, in the day of Campo Mayor, before I was shot through the body; but it was so slight a wound, in comparison to the other, that little or no notice was taken of it by myself, or any one else.

"I now gradually recovered my health; and, in the spring of 1815, accompanied the 10th Hussars to Belgium, and served at Waterloo, and during that campaign, with the exception of being in the possession of the French for a few minutes, in the cavalry affair of the 17th of June, under Lord Anglesey, escaped unscathed.

"My health gave way in 1821, and I certainly was in a precarious state for three or four years; but I gradually recovered, and by dint of great care and attention to diet, I am now in robust health, and can take with impunity the strongest exercise.—Dec. 14, 1846."

Case 40. John Richardson, of the 1st Royal Dragoons, was wounded at the battle of Waterloo, by a musket-ball, which entered two and a half inches above the umbilicus, and passed out on the left side, close to the lumbar vertebræ. He threw up a considerable quantity of blood, and the stomach was so irritable that nothing would remain on it. He complained of pain (which cut him right across, as he termed it); his eyes were suffused, and face flushed. Had head-ache; the pulse was 130. Thirty ounces of blood were taken from the arm, emollient injections were thrown up the rectum, and poultices applied to the wounds.

June 20.—Some blood came away with the injections during the night; there is great tension of the abdomen. Complains of great pain in the right side and shoulder. Saline draughts will not remain on his stomach, and are returned, tinged with bile and blood. Pulse 130; bled to 16 ounces; injections and poultices continued.

21.—A draught remained two hours on the stomach; when thrown up, it was mixed with blood, and a large quantity of bilious fluid. He was attacked with diarrhœa during the night, and the fœces were mixed with blood. Pulse 120, and full; skin hot, and tongue furred in the centre; venæsectio ad ℥xij. The blood taken from the arm is sizy. A little coffee, which he asked for, remains on his stomach.

22. Slept a little during the night; had several alvine evacuations, mixed with bilious fluid and blood. The tension of the belly is not so great; skin cool; tongue clean, but dry. He still complains of pain (in his inside, as he terms it); pulse 110, but very full. Tea remains on his stomach, but says he feels as if something very heavy was pressing on it; his face is still flushed. Venæsectio ad ℥xij.; fomentations and poultices

to the belly; chicken and beef broths; injections frequently.

23.—Slept a little during the night; feels much better; had several evacuations, mixed with bile only; skin cool; and tongue not so dry. He still complains of weight at the stomach. Beef tea is retained; face not so flushed; pulse 110, but soft.

24. Had several alvine evacuations since yesterday; feels considerable relief, from the tension of the abdomen having subsided; threw up his tea and a quantity of clotted blood this morning, which appears to have removed the sense of weight he complained of; pulse 104, and soft.

25. Slept four hours during the night. Beef-tea, &c., remains on the stomach; pulse 104. He still complains of pain in the direction of the wound. Fomentations, poultices, and injections continued.

26. Had a bad night; pulse 125, and full. Complains of great pain in the hepatic region and stomach, and backwards, towards the spine; tongue dry, and skin hot. Venæsectio ad ℥xvj. ℞. Hydr. submuriat: gr. iv. conf. rosæ gr. ix. ft. Pil. ij. capt. j, bis die.

27.—The pills operated; perspired in the night; skin soft; pulse 112. Repetantur pilulæ ex. Hydr. submuriat.

28.—Is much better in every respect. Broths, &c. remain on the stomach; skin cool; bowels open; only two of his stools were tinged with blood; pulse 109.

29.—Feels a sense of weight at the stomach this morning, and has nausea. Complains of much pain in the direction of the wound. Medicaments as before; discharge from the wounds of good consistence; pulse 114.

30.—Vomited in the night, mixed with blood; tea, &c., remains on the stomach this morning; pulse 108.

July 1.—Is in all respects better; the pain in the direction of the wound is relieved; broths, &c., remain on the stomach; pulse 100.

5.—The adnatæ have a yellow tinge; in other respects, is doing well. ℞. Hydr. submuriat; gr. x: extract. colocynth; ʒi. ft. pil. x. capt. i, ter in die.

8.—Is free from pain, the wounds discharging healthy pus; appetite and pulse good.

12.—Was able to sit up in bed yesterday for several hours; complains of being deprived of food.

20.—The wound perfectly healed; is cleaning his accoutrements, boots, &c. Was discharged on the 28th July, perfectly recovered.

John A. Campbell, Surgeon to the Forces.
*In charge of Elizabeth Hospital, Brussels.*

Case 41.—Owen Mc. Caffrey, aged 33, 1st battallion 95th regiment, was wounded on the 18th of June, at the battle of Waterloo, by a musket-ball, which penetrated the cavity of the abdomen, on the right side, about midway between the superior anterior spinous process of the ilium, and the linea alba; when admitted into the Minimes General Hospital, three days after, he was in the most deplorable state; the whole abdomen was tense, and exquisitely tender; the pulse small and wiry; vomiting incessant, with hiccough, and ghastly visage; from this period to the 24th, he was thrice largely blooded, and the strictest antiphlogistic plan was laid down, and rigidly adhered to. Laxative injections were administered, the whole of the abdomen was frequently fomented, and opiates were administered to allay the irritability of the stomach, and to procure ease and rest. On the 25th, the wounded intestine sloughed, and the fœces escaped by the external orifice, the adherence of the two surfaces of the peritonæum preventing any, even the smallest portion, getting into the cavity of the abdomen.

26th. The high inflammatory action having been reduced, milk, rice, and sugar, and the farinaceous part of the potatoe, were allowed.

27th. The debility being very considerable, eggs and wine were added to his former diet.

July 1st, No very alarming symptom remains; half a fowl ordered for his dinner, and the greatest attention to personal cleanliness directed to be paid.

7th. Strength slowly but gradually returning. The action of the large intestines is daily kept up by stimulating injections. The fœcal discharge from the wound diminishes. Draughts, with infusion of columba and tincture of rhubarb, are given twice a day.

14th. Progress to recovery satisfactory. The injections are daily repeated, and the discharge by the natural passage increases. The wound contracts and looks healthy. Is enabled to sit up, and has recovered his cheerfulness,

24th. Goes on remarkably well. The same plan is pursued, courting the action of the large intestines by thin stimulating injections, daily repeated; giving tone to the digestive organs by the bitter draughts, and increasing the general strength by generous and nutritive diet.

28th. Still improving, and promising ultimate recovery. Embarked, in the best spirits, for England.

J. Cole, Surgeon to the Forces.
Antwerp, August 27th, 1815.

P.S. I should have observed that the situation of the ball was never ascertained.

General Hospital, Yarmouth, Sept. 16th, 1815.

Owen McCaffrey was admitted on the 10th of August from Antwerp; health a little impaired; countenance pallid; tongue white; without thirst; appetite good; wound looking healthy. Until the 1st of September, fæculent matter was discharged from the wound, which was dressed with a simple compress; it then ceased. He takes a mild aperient every other day, and is now nearly well.

Robert Moir, Hospital Assistant.
To G. J. Guthrie, Esq.

Case 42.—A serjeant of infantry was wounded at the storming of San Sebastian, by a musket-ball, in the right hypogastric region, which entered an inch from the anterior superior spinous process of the ilium, passed across the cavity of the abdomen, and came out close to the sacrum on the same side. The fæces were discharged through the anterior wound for a long time, particularly after meals. The symptoms were not at first severe, although he was bled four different times. In August, 1814, he arrived at Plymouth Hospital, lame, from a shortening of the limb of the side wounded; it was drawn forwards on the trunk, probably from the psoas muscle having been injured. Fæcal matter was no longer discharged from the anterior wound, which was open, and giving out a little watery matter, with some flatus. The posterior wound healed readily, never having discharged any fæces. He suffered frequently from constipation and colic, and was obliged to take aperient medicines on such occasions. He was strong and well in health, although his countenance, of a dusky colour, indicated perhaps some sort of visceral derangement, when he was discharged.

Case 43.—Colonel Ouseley was wounded, in the south of France, at Arbas, on the 3rd August, 1813, by a musket-ball, which entered three inches below the umbilicus, and a little to the left side, and passed out close to the posterior spinous process of the ilium behind. He passed fæces through the wounds, and blood per anum, for six or seven days, when the severity of the symptoms subsided under a vigorous treatment. Matter formed between the muscles, and had to be evacuated by incisions. Sensation and motion were lost on the outer part of both legs; the right has recovered, but motion is impaired in the left, and sensation is deficient on the outside of the thigh, of the calf of the leg and buttock, now, fifteen years after the receipt of the injury when this note was written.

The following case, from Baron Larrey, was very successful:—

Case 44.—M. N. was struck at Cairo, in 1799, by a musket ball, which cut through the wall of the abdomen, and wounded the ilium. Both ends of the bowel protruded, were swelled, and turned back on themselves, so as to form a stricture on the gut, preventing the passage of anything from above. The Baron divided the contracted end of the intestine with the scissors in four places, so as to remove the strangulation; and having passed a suture through the mesentery close to the divided intestine, he returned it to the cavity of the belly, fastening the ligature to the external parts. The symptoms which followed were severe for some days, but gradually subsided; the contents of the bowel passed through the wound, and two months afterwards the ends of the intestine were seen to be in contact with each other. The parts were then dressed after the manner, and from time to time during two months, with the tampon or plug of Desault; at the end of which time the patient recovered.

I have seen several similar cases in British soldiers, but they nearly all died of their injuries during the inflammatory stage. In this case, although successful, there can now be little doubt that the more proper course to be pursued would have been the employment of the continued suture. As the external wound could not unite or meet closely, the retention of the intestine by a thread near the opening could do little harm if it did no good, and no real assistance was given by art to nature.

Case 45.—In a soldier, of la jeune garde imperiale, under the care of staff-surgeon Dumoulin the ball entered to the right and a little below the umbilicus, and passed out on the left or opposite side, about two inches above the crest of the ilium. It was supposed to have entered, and to have passed along the canal of the great, arch of the colon. Fæcal matter, much tinged with bile, passed by both openings. The symptoms of inflammation were severe for the first few days, but gradually yielded to the means employed, when the bowels began to act regularly by the aid of mild injections, and the discharge from the wounds gradually lessened; the man was much reduced, but otherwise in good health, and was sent to France from Brussels nearly well.

Case 46.—A soldier, of the 3d division, whilst moving forward immediately under the orders of General Sir James Kempt, after the first charge of heavy cavalry at Waterloo, was struck by a musket ball on the right iliac region, a little within the anterior superior process of the ilium; it passed across and came out a little below the umbilicus on the opposite side. A fæcal bilious discharge, evidently from the small intestine, took place from the first day from both orifices; the symptoms were at first severe, but were subdued by vigorous treatment; the wounds gradually closed in, and the man was sent to England to be discharged, well although weak.

It may be questioned whether these patients would have done as well, if the external openings had been enlarged in the first instance, to allow of sutures being applied to the wounds in the intestines. It must, however, be recollected that these were cases of recovery, and that numbers of others, perhaps similarly as well as more seriously wounded, had died. It will be for those who follow us to decide a point so important, and to which their best attention will now be drawn, in a manner which, I trust, cannot fail to be of service. The late Dr. Thomson, in summing up his remarks on what he saw on this subject, after the battle of Waterloo, says, p. 106, "The more that is left to nature in the progress of reunion, and the less her operations are interfered with, the greater will be the chance of ultimate recovery." The remark is correct, provided it be applied to those cases, in which no clear indications for interference are present. When they are present, the do-nothing system is generally followed by death. A well regulated interference is likely to be more successful.

CASE 47.—On the advance of the British army, in 1809, from Coimbra to Oporto, the French rear guard halted in front of a wood near Grijon, and a sharp affair took place for their dislodgment. The first man wounded was shot in the abdomen. The ball entered about an inch below the umbilicus and lodged, giving him great pain. I saw him within five minutes. He said he was killed, and looked like death. He rallied but little, and continued to suffer pain until the next day, when he died, in spite of all the means adopted for his relief.

CASE 48.—A soldier of the French Imperial Guard, was wounded at Waterloo, and brought to the hospital at Brussels under Acting Staff-Surgeon Lyons, with two openings made by the entrance and exit of a ball in the fore part of the abdomen, below the umbilicus. He stated, that the bowel protruded at both openings, but being unhurt, was returned into the cavity, and the wound dressed with lint and adhesive plaster. The symptoms were severe, and continued with remissions until the sixth day, when the bowel gave way at a part where it had been apparently bruised by the ball; its contents were discharged by the wound of exit, for two or three days, when the patient sank and died.

CASE 49.—La Motte says in his 241st observation, that called to a young man wounded in the upper and lateral part of the epigastric region, he dressed the wound simply, and bled him once. On the fifth day symptoms of inflammation made their appearance, and on the eighth he died, in spite of the means employed. On opening the body he found the ileum wounded in three places, but the wounds was so small that he could only just discover them, and no effusion had taken place through them.

Thses cases may be compared with the preceding ones, in which the wounds being externally somewhat similar, the patients recovered, although the same treatment was carried out in all, and they may be also compared with the succeeding ones which are not less remarkable.

CASE 50.—A soldier, of the third division of infantry, was wounded during the assault of Ciudad Rodrigo, by a ball which entered and lodged in the left side of the back, about midway between the spine and a line drawn to the upper part of the crest of the ilium, and from which opening the contents of the bowel were discharged. Left among the dead, and those who were supposed to be dying, at the field hospital, in the rear of the trenches, I sent him, with all those of different corps who were not dead, including Lieut.-Colonel Grey, of the 5th regiment, and Captain Flack, of the 88th regiment, whose case I have elsewhere related, to my own hospital, that of the 4th division, at Aldea Gallega, some ten miles off. Here, under a sufficiently vigorous treatment, of which bleeding, starvation, and quietude were the prominent features, he gradually recovered. On the fifth day the ball passed per anum, and on two or three different occasions afterwards, portions of his coat, flannel-shirt, and breeches. Fæcal matter passed readily through the wound, whilst the bowels were gently solicited by common injections for some time; but the wound gradually closed in, and the man regained his health, and was sent to the rear, with a slight coloured discharge from the wound, not quite free from odour.

CASE 51.—Ensign Wright, 61st Regiment, was wounded by gunshot, on the morning of the 10th of April, at Toulouse. The ball passed through the abdominal parietes, on the right of the linea alba, and nearly half way betwixt the umbilicus and the pubes. Sense of debility, tremor, nausea, small feeble pulse, and pain in the lower part of the abdomen, were the immediate symptoms.

No tympanitic tension, increased pain, or vomiting, had occurred by 10 P.M.; several stools occurred in the course of the night, of a thin consistence, without admixture of blood.

Peritonitic and enteritic symptoms, of considerable violence, having begun to manifest themselves on the 11th, copious and repeated evacuations of blood were made, by order of Mr. Guthrie, the Deputy Inspector-General in charge of all the wounded. Fomentations were applied to the belly; abstinence in food and drink was strictly enjoined; and the most rigid antiphlogistic regimen followed. The same practice was pursued during the 12th, 13th, and 14th; venesection being performed either two or three times every day, as the augmented state of the local and general inflammatory symptoms seemed to require. The bowels, during the above period, had continued perfectly free, and the dejections were tolerably natural in colour, but rather dark, and extremely fœtid. He had been frequently troubled with nausea, and vomiting of bilious matter. Two small doses of castor oil had been exhibited.

Toast and water, tea, boiled milk and water, with a little soft bread soaked in it, and mutton and chicken broth, in small quantities at a time, were all that was allowed him for food and drink. His chamber was kept cool, and of equable temperature, and he observed silence and tranquillity.

April 15.—Pulse above 100, weak and small; temperature natural; the tongue clean. Continued affected with a degree of nausea and vomiting, after drinks especially; and some diarrhœa was present. The abdomen was not painful, even on pressure, except in the vicinity of the wound. In the evening he was much griped in the lower part of the belly; some degree of thirst was present; his pulse rose to 120; small, and not soft. Fomentations were frequently applied to the abdomen, and blood let to syncope.

16.—He rested well; free from pain of abdomen, except near the wound; several stools, natural in colour; thirst not so urgent; temperature natural; pulse 100, weak.

17.—Was bled last night to twelve ounces, in consequence of increased pain of abdomen and augmented pyrexia; to-day, quiet and easy, and has had several stools.

18. Diarrhœa and tenesmus troublesome during the night; *ball* voided with the fœces at six A.M.; it is somewhat flattened,as if from impinging on a stone; has felt easy since. Continue antiphlogistic regimen.

19.—Diarrhœa abated; but abdomen is tense and painful on pressure. He is distressed with nausea and vomiting; pulse 100, and sharp; great thirst; tongue dry. Venæsectio ad ℥xvj. Abdomen fomented.

20.—Venesection was repeated last night, from persistence of the symptoms of peritonitis. Blood drawn very buffy; has had several loose stools during the night. He is to-day easy; abdomen now scarcely painful. Fomentations continued.

29.—From the 20th to the 29th, he remained easy; the external wound had closed; he had continued free from pyrexia, and his evacuations had been regular.

In the morning his abdomen was tense and painful, on pressure; he was affected with nausea; and he had vomiting repeatedly during the night; thirst and pyrexia attended. Fomentations applied from time to time, and yielded relief. Suspect that he has not observed the regimen prescribed him.

May 1. Pain of abdomen, and bilious vomitings during the night. Dejectiones iij. liquidæ. Pulse 110; hard and small; thirst urgent. Blood let ad diliquium; fomentations continued.

2.—Last night was again bled to eight ounces, when deliquium supervened. He passed a quiet night; had two liquid stools; his abdomen is not painful; nor is he sick at stomach, or thirsty. To keep himself warm, particularly the belly.

3.—Passed the night quietly, and says he is easy; pulse 96; skin moist and cool. Nil.

4 to 10.—These days were passed quietly; and without any material deviation from the healthy state occurring.

11.—Suspect he has been rather irregular in diet. Passed a bad night,partly in delirium; has vomited much: he has obviously pain on pressure of the abdomen, but he appears studious to conceal it; pulse 112, small, and not soft; temperature increased; tongue red; thirsty; dejectiones iij. liquidæ; foveatur abdomen; capt. tinct. digitalis gutt. x. ter in die in mucilag. g. arab. ℥ss.; dieta ex lacte et farrinaceis; pro potu, inf. theæ. parvulis haustulis.—Horâ 8. Pulse 120, soft; feels easier, and has not vomited; adhibeatur pediluvium.

12.—Pulse 120, soft; says his abdomen is not painful; seems yet averse to its being pressed; says he has not vomited, and that he is not affected with nausea.—Dejectiones ij.; cont. digitalis; vespere, adhibeatur pediluvium.

13.—Molested by pains, nausea, and vomiting. during the night; pulse 110, not soft; skin cool, but is thirsty, and his tongue is of a vermilion colour, and arid; confesses that he has hitherto disguised his feelings, as well as other circumstances connected with his case, particularly his manner of living.—Cont. digitalis; applicetur vesicatorium regione epigastricâ; vespere utr. pediluvium.

14.—Bad night; pulse 112; skin hot; pain of abdomen not urgent; no vomiting, but is affected with nausea.—Cont. digitalis. Horâ 4, pulse 100; feels nauseated; no pain of abdomen; interm. digitalis.

15.—Rested ill, and is occasionally griped; pulse above 100, of quick beat; no nausea.—sum. ik. digital. gtt. xij.; 3 qq. horâ. Horâ 8, interm. digitalis.

16, 8 A.M.—The tendency to vomit continues; capt. pil. ex cal., gr. iss., opii gr. iss.; mane; et ft venæsectio.—7 P.M, vomits whatever he swallows in any quantity; is molested with cough; skin hot; thirst great; tongue red; dejectiones ij.; says abdomen is not painful; pulse 112.—Iterum applicetur vesicator. epigastrio; vespere pediluvium; utr. mist. mucil. pro tussi.

17.—Rested ill; blister has not risen; cough has been severe, and continues so; dejectiones ij.; pulse 120, and not soft; cough augmented by deep inspiration, and pain produced.—Effluat. sanguis e brachio ad ℥viij.; vespere, adhibeatur pediluvium. Cont. pil.

18.—Bad night; cough gone; respiration easy; pulse 100; skin cool and moist; no thirst.—Dejectio j. naturalis; rept. mucilag. et pil. cal., et op.

19.—Has continued easy; pulse 100; repet. pil. cal. et opii. cont. mucilag.

20 to 23.—Easy; functions undisturbed. Is allowed some strawberries and milk.

24.—Has this morning experienced a severe attack of dyspnœa, attended by cough, and pain of breast, both increased by full inspiration. Pulse 120; face flushed. Says he caught cold from exposure in the night.—Perficiatur illico venæsectio, et effluat sanguis prout vires sustulerint; utr. pediluvium vespere.

25.—Six ounces of blood drawn; surface buffy; bad night; cough, pain, and pyrexia abated this morning; Vespere, severe dyspnœa; cough and pain of breast have recurred; pulse 120.—Exhr. sang ad ℥vi. nisi virium defectus obstiterit; at. mist mucil; iterum applic. vesicator. pectori.

26.—Relieved by the bleeding; feels easy, aving slept well; pulse calm.—Dejectiones vigilis; cont. mucilag. Ate a little meat at dinner.

27, 28.—In a fair way of recovery; and was discharged, for England, in June, with little or no complaint.

JOHN MURRAY, *Surgeon to the Forces.*

CASE 52.—Sergeant Mathews, of the 28th regt. was wounded, at Waterloo, by a musket-ball, about an inch below the umbilicus, and a little to the right side, which lodged. He walked to a village in the rear, where he remained for three days, having been bled each day, ad deliquium, before he was removed to Brussels, where my attention was particularly attracted to him, in consequence of his having passed the ball (a small rifle one) per anum, three days after his arrival, or the sixth from the receipt of the wound. The wound was healed by the end of August; and he felt so well that he marched to Paris, with other convalescents, to join his regiment. After some weeks he got drunk, and suffered from an attack of pain in his bowels, in the situation of the wound, requiring an active treatment. On attempting one day to have a motion, he found, after many efforts, that something blocked up the anus, and, on taking hold of, and drawing it out, he found it was a portion of the waistband of his breeches, including a part of the button-hole; a fact verified by Staff-Surgeon Dease, who wrote to me an account of this peculiar case. After this, the man recovered without further difficulty, although, as in all such cases, there was a herniary projection. He was afterwards subject to costiveness, to pain in the part after a copious meal, probably from the stretching of the adhesions formed between the intestine and the abdominal peritoneum, and which at first, inclined him to bend his body forwards; hence, the direction of some of the older authors to keep the body inclined backwards during the cure: a direction to be more honoured in the breach than in the observance.

In all such cases, the extraneous substance having lodged, and in wounds from balls, having destroyed, or mainly injured, in all probability, the vitality of the part which assists in the lodgment, it becomes covered with a layer of coagulable lymph, or fibre, capable of retaining it in its new situation, whence it is gradually removed by ulceration, or by the sloughing of the injured parts into the cavity of the bowel; much in the same manner as an abscess in the liver is evacuated into the duodenum, or neighbouring intestine, to which it may become attached. It is always fortunate when the canal from the external wound is cut off by the deposition of lymph, as it expedites the cure, and renders the injury less formidable; but, if this should not take place, the contents of the bowel are discharged through it, for a greater or less length of time, until the canal between the parts gradually closes and cicatrization takes place; in default of which, an artificial anus may remain in addition to the natural one, the functions of which, as well as of the bowels generally, are performed with more or less difficulty.

The latest instance of a ball passed per anum is that recorded by Dr. Cox, in the *Repertorio Medico-Farmaceutico de la Sociedad de Emulation di Barcelona*; a lad, fifteen years old, who, having been wounded by a musket-ball, on the left side of the chest, between the fifth and sixth ribs, passed it on the sixth day, per anum, without having suffered any symptom of derangement of the alimentary canal, or lesion of the diaphragm. He died on the twelfth day. The ball had passed from the base of the lung into the stomach, and adhesions had formed between the diaphragm and that organ, the opening into which was round; the whole of the left lung adhered to the pleura costalis, and was infiltrated with pus.

Ancient authors, such as Ravaton, mention the passage of a round leaden bolt. Bilguer, Schenkius, Manjet, Wesler, of balls per anum; Benedictus, of part of the head of an arrow, which had entered at the back; Didier, of the end of a sword which had broken off in the belly, &c. &c.

# LECTURE IV.

*Treatment of hæmorrhage consequent on wounds of the abdomen; Enlargement of the external wound requisite, when the abdomen is painful, tense, and manifestly full, from effused blood; Petit fils' opinion respecting extravasation of blood into the cavity of the abdomen; Evacuation or absorption of the effused blood when in small quantity; Blood, when not absorbed or evacuated, becomes a source of irritation, and is enclosed in a* foyer *of fibrine, followed by inflammation and suppuration; Use of the exploring needle, or fine trocar and canula in such cases, prior to making an incision in the abscess; Cabrol's case of wound of the liver, followed by effusion of blood into he cavity of the abdomen, and consequent suppuration, he effused and secreted matters being removed by enrgement of the external wound; Argaat and Petit's ses of suppuration following effusion of blood into e cavity of the abdomen, consequent on wounds; vaton's cases of general suppuration of the cavity the abdomen, following penetrating wounds; Dr. uart's case of sword-wound of the abdomen and l bladder, with considerable effusion of bile into abdominal cavity; Sabatier's case of wound of fundus of the gall-bladder, followed by free effu- of bile into the abdominal cavity; M. Biot's case ppurating tumour in the abdomen, through which ylinder of intestine, and fæcal matter were disged; Mr. Fryer's case of injury to the liver, effusion of bile into the cavity of the abdomen; Archer's case of wound of the stomach, followed uppuration in the abdomen; Dr. Fuschtius' of intus-susception, in treating which the ations of gastrotomy and enterotomy were essfully performed; Dr. Johnson's case of nal strangulated hernia; Dr. Manlove's case of ruction of the bowels, successfully treated by the ration of gastrotomy; Dr. Wilson's case of intusception, cured by operation; Dr. Maclean's case strangulated inguinal hernia, in which the operan was performed, followed by sloughing of the bowel, ad formation of an artificial anus, which ultimately osed; Dr. Bird and Mr. Hilton's case of internal rangulated hernia; Baron Larrey on effusion of ood into the cavity of the abdomen, and on wounds the intestines; His opinions examined and controrted; Treatment of wounded intestine, the wound ing readily seen or felt, and freely discharging the ntents of the bowel; Experience of the surgeon of Gensd'armerie hospital at Brussels; Case of innal strangulated hernia terminating fatally; The mation of a sac or foyer round extravasations in abdomen, very rare in natives of the northern climates; General treatment to be pursued in the acute stage of inflammation in these cases; The practice of Continental surgeons in the treatment of gun-shot wounds of the abdomen; That practice controverted; Cases in which musket-shot wounds may be enlarged; Local treatment by ancient and modern Continental Surgeons.*

As long as an incised wound in the abdomen discharges blood, its edges should be kept asunder, so that the blood may have a ready exit, unless it shall be deemed expedient to search for the wounded vessel, in order to secure it, and put a stop to the hæmorrhage. When it is presumed that this cannot be done successfully, or with advantage to the patient, whose life is in jeopardy from the continued drain, the wound should be closed, a compress laid over it, and retained by a bandage methodically applied for the purpose of aiding the muscular paries in keeping up that pressure on the viscera, which may be useful in arresting the flow of blood from the wounded part. If the bleeding should continue, and the belly become in consequence distended, the sutures being evidently so tense as to be likely to cut their way through the soft parts, or if the blood should ooze out between the stitches, they may be in part removed, in order to give that immediate relief which the death of the patient, if the bleeding should continue, can alone make permanent. When the belly becomes very painful, tense, and manifestly full, after a punctured wound, and not tympanitic from the extrication of air or the distension of the bowel, the wound should be enlarged, to allow the evacuation of the extravasated blood, which cannot in such quantity be absorbed. The orifice of a small gun-shot wound, which is not sufficiently direct to communicate with the cavity, and to allow the issue of blood extravasated in the quantity alluded to, should be enlarged to such extent as will effect this object.

Petit-fils was the first to point out, that extravasations of blood of a determinate quantity, were not diffused all over the surface and between the convolutions of the small intestines and behind them, provided the person outlived the period of extravasation; and that a general effusion into the cavity took place, shortly before or immediately after death, (see his *Memoires sur les Epanchements*, in the first and second volumes of the *Academie de Chirurgie de Paris.*)

Blood effused in moderate quantity and circumscribed by the pressure exercised upon the contents of the abdomen by its paries, may readily be evacuated by the wound, provided it be sufficiently open; and the patient will recover, if the inflammation which must necessarily ensue, should not be communicated along the peritoneum throughout the cavity, or if it should be subdued in time. If the blood be in small quantity it coagulates, and may be absorbed, but if in such quantity as that it cannot be absorbed, or from any other causes which may prevent its removal by this means, it becomes after a time a source of irritation, and nature, according to Petit and Larrey, commences early to cut it off from the general cavity, by surrounding it with fibrine. This is deposited on all the neighbouring parts, forming a pouch-reservoir, or *foyer*, the product of inflammation, which has been restrained within those bounds which admit of such formation taking place, without implicating to any essential degree the general cavity, a result which Garengeot denied, and whose opinion Messrs. Velpeau and Vidal now support.

When extravasated blood is thus cut off from the general cavity, and cannot be absorbed, or by accident carried off through an opening in the bowel, a change takes place in it, by which it ceases to be bland and harmless, and which renders it irritating, thereby exciting inflammation like any other foreign body, and its ordinary consequence suppuration, if the patient should survive so long. This occurs, for the most part, after the first inflammatory symptoms have subsided, from the tenth, to the twelfth, or even a later day; when the renewal of irritation is accompanied by an increase of the general symptoms, by a more local pain, and by a circumscribed swelling of some part near the wound, in which fluctuation may perhaps be distinguished, even during the existence of the general tenderness of the whole abdomen. Under such circumstances, and when it is proposed to make an incision into this part, if it should be thought advisable to do such operation, it may safely be preceded by an exploring needle, or very fine trocar and canula, which will demonstrate the fact of the purulent and sanious depôt, without doing in such a case much mischief, if the expectations of the surgeon should not be realized. If the exploring needle should show that a bloody, purulent, or other fluid, is really distending the abdomen, no doubt ought to be entertained about enlarging the original wound, or of making a more depending opening. The treatment of the sac is to be afterwards conducted in the most gentle manner.

CASE 53.—Cabrol, of Montpelier, Surgeon to Montmorency, the Constable of France, appears to have been the first who enlarged a wound in the abdomen, for the express purpose of letting out blood and matter from its cavity. In his eighteenth observation, published in Geneva, in 1604, he states the case of a man who had wounded himself in the liver, from which wound he lost a considerable quantity of blood; but, as all could not escape, some gravitated to the lower part of the cavity, and gave rise to the formation and putrefaction of matter, accompanied by so horrible a stench as to be unbearable. He decided on enlarging the wound, which enabled him to remove the offending blood and matter, by the aid of the handle, and even of the bowl, of a table spoon, three times a day, until the person recovered.

CASE 54.—Petit relates the case of a soldier, under the care of M. Argeat, Surgeon to the Regiment of Normandy, who was wounded by a sword a little below the ensiform cartilage, and the edge of the false ribs on the right side. The wound was less than half an inch in extent, and only allowed the escape of a few drops of blood after every attempt made to discharge it. The day after the accident he was sent to the hospital of Besançon, and placed under the care of M. Vacher. He continued, under proper treatment in a favourable state until the night of the ninth day, when the fever returned, with tension, and pain in the hypogastric region. On the twelfth day, the belly was more tense, and elevated at a particular point, which gave on examination some signs of fluctuation. Messrs. Argeat, Vacher, &c., having agreed upon making an opening into the cavity of the belly, M. Vacher operated on the most prominent part of the swelling, an inch above the right abdominal ring, and about the same distance from the rectus muscle, making an incision two inches long through the wall down to the peritoneum, but only large enough to admit the point of the little finger through that membrane; upon which three half pints at least of black blood, mingled with some serous fluid, were discharged. The wound was dressed simply, with the exception of the introduction of a piece of linen, two inches long and half an inch wide into the abdomen. The next morning another half pint of bloody fluid escaped, and the patient began to amend. On the third dressing a little blood and pus were discharged. The cavity was injected with wine sweetened with honey, but as that gave pain, barley-water was substituted until the fifth day, when the suppuration being abundant it was omitted. The man was cured by the thirty-sixth day.

Petit himself, in a nearly similar case, did the same thing, but having delayed the operation too long, the man died he thinks of mortification of the bowels. On opening the body, he found a pint of bloody matter enclosed in a pouch, of which the cavity of the pelvis formed the lower part, the intestines adhering to each other at the upper and back part, and to the peritoneum in front.

CASE 55.—In his twenty-third observation, Ravaton relates the case of a dragoon, wounded by a bayonet in the right hypochondrium. He suffered severely from inflammatory symptoms for several days, when the wound opened, and discharged a quantity of the most fœtid matter. The wound was enlarged, and a pint of bad fœtid matter mixed with pieces of omentum was discharged. The cavity of the abdomen was washed out by mild detersive injections three times a day, and large quantities were evacuated by pressing on the abdomen.

CASE 56.—Ravaton in his twenty-second observation, page 492, relates the case of a sergeant in the Regiment of St. Germains, wounded ten days before, near the umbilicus, with a sword. Under the wound in the abdominal wall he thought he felt a fluctuation, but as he considered the man to be dying, he refrained from dilating it. The next morning he found the patient inundated with black, bloody, purulent matter, which had come through the wound, which he enlarged, and thereby admitted the escape of a further quantity of a similar fluid, mingled with pieces of omentum; mild injections were thrown into the cavity of the belly to cleanse the viscera; emollient applications were made to the external wound, and the man was laid upon his face; he gradually recovered by the 57th day. The discharge was in this case so fetid, that the cavity of the abdomen had to be washed out three times a-day during the first eight days after he came under Ravaton's care.

CASE 57.—In his twenty-fifth observation, Ravaton relates the case of a soldier, who was wounded five days before, by the point of a sabre, to the right of the umbilicus. The belly, when the man was rought to him, was swelled, hard, and very painful, ith vomiting, hiccough, &c., announcing the aporoach of death. Believing that the abdomen conined a fluid, either effused or secreted, he made opening into the cavity immediately above oupart's ligament, on the outside of the internal ening of the ring of the right side, when finding at nothing came from the cavity, he passed his iger upwards along the iliac vessels; and after aring up some membranous adhesions, evacuated pint of coagulated blood and fœtid serous fluid. He then introduced a dossil of lint into the wound to keep it open, fomented and oiled the belly, round which he applied a bandage, and placed the patient on his face. The bad symptoms diminished during the night, and the patient declared himself better in the morning. From the fifth to the tenth day of the wound he was in extreme danger. On the eleventh, the bed was inundated with a purulent matter of an almost insupportable smell. The cavity of the abdomen was injected and cleansed, the ordinary dressings applied, and the greatest cleanliness observed. He was subsequently dressed three times a day in a similar manner; portions of omentum were occasionally drawn away with the forceps. His strength was well supported by every kind of nourishment. The night sweats continued until the thirty-third day, and on the seventy-second he was discharged from the hospital cured. The discharge at first was serous, and only became purulent on the sixth day after the operation.

CASE 58—By Dr. Stuart, in the *Philosophical Transactions* for 1728: Sergeant Menzies, of the Horse Grenadier Guards, was wounded by the point of a sword, on the 30th October, 1728, which made a triangular wound, two inches to the right of the navel, and was soon followed by great distension of the abdomen, which continued until his death on the seventh day, his bowels never having acted during that time. Pulse full, strong, and even, but not quick, until the last day, when it intermitted; skin without feverish heat; tongue natural, with a silky dryness, but with little saliva; some few occasional retchings, and hiccough; pain not noticed. During the seven days he did not sleep more than half an hour at a time, and that rarely, in spite of opiates. On dissection, the point of the sword was found to have slightly injured the omentum, and to have pierced the bottom of the gall-bladder, making a small triangular wound in it. The intestines were distended with air to three times their natural size, and about three quarts of muddy serum, highly tinged with bile, were contained in the cavity. No inflammation appeared in any part of the intestines, or other viscera, which were all sound and healthy. Dr. Stuart attributes death to the absence of bile from the bowels. It would now be attributed to peritonitis; and surgery might have done some good, by enlarging the wound, or by paracentesis of the abdomen, which might have delayed the approach of death.

CASE 59.—Sabatier, page 154, vol. 2, *Medicine Operatoire*, Paris, 1822: A man, wounded in the direction of the gall bladder, became rapidly swollen, with difficulty of breathing. These symptoms were followed by tension and pain in the right hypochondrium; pulse frequent, small, and concentrated; extremities cold; countenance pale. He was relieved by two bleedings. On the third day, Sabatier saw the belly was more elevated at the right inferior and anterior part than at any other, and a fluctuation was manifest in it to the touch. A trocar being introduced, gave issue to a quantity of inodorous, blackish-green fluid, evidently bile. The man died a few hours afterwards. On opening the body, a considerable quantity of yellow bile was found between the abdominal peritoneum and the intestines, but which was prevented from passing between the convolutions, by a quantity of lymph, which agglutinated them together. The gall bladder was empty, and the wound was in its fundus.

CASE 60.—From M. Biot and *Medico-Chirurgical Review*, for 1818.—J. B. Matheen was received into the Hospital at Besançon, for the cure of a suppurating tumour between the ilium and the umbilicus, the opening of which gave issue to a considerable quantity of well-formed matter, and the finger could be introduced throuh a hole in the peritoneum into the abdomen. The opening was enlarged, and the patient kept as much as possible on his back for several days, when an aperient being given, two large lumbrici came through the wound, and the dressings for the first time were soiled with fecal matter. A new abscess, after a little time, formed within an inch of the symphysis pubis, and was opened. Six days afterwards, a membranous substance which presented itself was removed, and found to be an entire cylinder of intestine, near two inches in length. For some days the whole of the fœces passed by this wound, and also some worms; this, however, gradually decreased, the natural passage was restored, and at the end of fifty-seven days the man was discharged cured.

CASE 61.--Mr. Fryer, of Stamford, has recorded, in vol. 4, of the *Medico-Chirurgical Transactions*, the case of a lad, thirteen years old, who, in 1803, received a violent blow from the shafts of a cart, in the region of the liver, which was followed by the severest symptoms common to such accidents. On the fourth day he was completely jaundiced, although the general symptoms had in part diminished. Ten days afterwards, the sinking of the abdomen had increased, and fluctuation was perceptible. Twenty-one days after the accident, he was apparently sinking fast, the belly being greatly distended; it was, therefore, thought desirable to introduce a trocar and canula, to evacuate the distending fluid, which being done, thirteen pints of what appeared to be pure bile were removed. Twelve days afterwards, fifteen pints more were drawn off; and, nine days afterwards, thirteen more. Eighteen days afterwards six pints more were taken away; after which he gradually recovered. The fluid drawn off was not examined chemically.

CASE 62.—Dr. Archer, of Maryland, has recorded, in the *New York Medical Journal*, vol. xv. p. 215, the case of a man wounded by a knife, which entered near the cartilages of the false ribs on the right side, and penetrated the stomach, touching the cartilages of the opposite side. The external wound was three inches long, that in the stomach two inches. His dinner was discharged through the cut, and some escaped into the cavity. The external wound was stitched up, but the ligatures were removed in forty-eight hours, and the wound dressed simply. On the ninth day, pain was felt in the groin, suppuration took place, the part was opened, and a large quantity of pus, mixed with pieces of cabbage, was evacuated. The man then got well, with a hernia of the stomach, which would appear after eating or drinking, and recede when the stomach was empty.

CASE 63.—Dr. Fuchsius, in Hufeland's Journal for February, 1825, reported in Johnson's *Medico-Chirurgical Review* for the same year, relates the case of a labouring man, who suddenly felt a dragging pain in the umbilical region, whilst collecting wood in the district of Olpe. Not being relieved by the means employed, Dr. F. saw him four days afterwards, and continued the remedies, with venesection, &c., until the eighth day; when, convinced that the symptoms depended on some mechanical obstruction, as a swelling as hard, and nearly the size of the fist, could be felt about the angle formed by the ascending and transverse portions of the colon, he proposed an operation, as the sufferer seemed to be beyond all hope of recovery by any other means; and performed it on the tenth day, by making an opening at the outer edge of the rectus muscle, to the extent of from two to three inches. He then introduced his hand, smeared with oil, into the cavity, and after some search, discovered a hardened part in the ileum, opposite where the tumour had been felt externally. This part of the intestine he drew out; it was neither inflamed nor distended, but contained in its cavity a soft compact mass, which could be felt as far as he could follow the intestine. He distinctly ascertained an intussusception, but could not reach the commencement of it, so as to bring it out; and, therefore, opened the gut, to the extent of two inches, rather than the opening in the abdomen (which would now be considered a great error), when a portion of the invaginated intestine was brought into view, which he succeded in unfolding, to the *extent of two feet*. There were not any traces of inflammation, or of any of its consequences, to be seen. The wound in the gut was closed by six stitches of the glover's suture, the ends of the silk thread being brought out of the wound; the integuments were closed by the interrupted suture, and the patient put to bed, broth and gruel only being given alternately, for some days. A natural motion took place two days after, and on the fourteenth day, the man was cured, and remained well. Dr. F. says, Nuck performed a similar operation, and that it is recorded in Haller's *Disputationes*. There are many cases recorded, and I have seen two myself, in which an incision into the cavity of the abdomen would have led to the removal of the immediate cause of death.

Dr. Johnson in commenting on the case of Dr. Fuchsius, mentions that of a young man, who when with Belzoni in Egypt, had suffered from peritonitis, and ever afterwards from long habitual constipation. Seized some years after in London, by pain, after lifting a heavy weight, followed by stercoraceous vomiting, dreadful colicky pains, and great distension of the abdomen, he died at the end of ten or twelve days, unrelieved in any way. On examination of the body, a portion of the ileum was found entangled under an old band or bride, formed possibly in Egypt, and was easily drawn out, but a regular internal strangulated hernia had been the consequence. The intestines above were greatly distended, but there was no inflammation that could fairly account for the patient's death. Dr. Johnson says, he had not the smallest doubt that the operation of gastrotomy would have removed the evil.

CASE 64.—Dr. J. Manlove, in the *Boston Medical and Surgical Journal*, for July, 1845, relates the case of a coloured boy, seventeen years of age, on whom, in consequence of an enormously distended abdomen, with great difficulty of breathing, anxiety, and confined bowels, for twelve or fifteen days, threatening immediate death, he made an incision in the linea alba, commencing about two inches below the umbilicus, and extending for four or five inches towards the pubes. The peritoneum and intestines had formed an intimate union along the lower half of the incision ; and in separating them, the intestine was wounded to the extent of a quarter of an inch: through this came flatus, fæces, turpentine, &c., to the great relief of the patient. The wound was closed by suture and bandage, except at the part opposite to the wound in the intestine, through which the contents were discharged until the 17th day, when the bowels acted naturally, and the lad recovered.

The reporter, in advocating similar operations, adduced the case of a Negro, who being supposed to be about to die of intus-susception, had the abdomen opened by Dr. Wilson, and the intestines drawn out of the cavity, until the point of obstruction was discovered. An inch of the ileum was found invaginated; this having been relieved, the intestines were returned, and the patient recovered.

These last two cases shew that much more may be done, in many constitutions, than is usually attempted, and that nothing should be neglected, when there is a reasonable chance of success.

CASE 65.—Thomas Mc. Mahon, 76th Regiment, aged 22, was admitted into the Garrison Hospital, Portsmouth, upon the 13th of June, 1845, with all the symptoms of strangulated inguinal hernia of the left side, of two days' standing.

The remedies of every description employed having failed and the symptoms becoming more urgent, I performed the operation. Considerable difficulty was experienced, from some strong adhesions existing between the intestine and hernial sac, the former of which was perfectly black. The adhesions were gently broken up, and the parts returned in the usual manner. The patient experienced immediate relief, and all the symptoms of an urgent nature appeared to be arrested; as however there existed considerable tenderness of the abdomen upon pressure, fifty leeches were immediately applied with the most decided benefit, and in the evening a little castor oil was given, which the following morning acted gently upon his bowels; from that time everything went on favourably, till the morning of the fourth day after the operation, when he made a sudden effort to go to the closestool, (although ordered not to do so) which was immediately followed by the descent of a considerable portion of intestine and omentum, accompanied with profuse hemorrhage from a small artery on the surface of the intestine, which was taken up and tied, and the parts returned into the abdominal cavity. The greatest excitement followed, with every symptom of acute inflammation. These were treated by general bleeding to the extent of fifty ounces, and sixty leeches to the abdomen, with other antiphlogistic remedies. It was, however, evident from a slight discharge of fæculent matter from the wound in the inguinal region, that serious mischief to the bowels had taken place; and upon the morning of the 17th day from the performance of the operation, a piece of intestine came away with the fæcal contents of the bowels, after which the patient experienced relief in all his symptoms, and appeared to gain health and strength, and after a time the wound seemed disposed to close, three weeks after the sloughing of the intestine. The bowels were opened per anum, and the wound was allowed to heal up, the natural functions, we hoped, being fairly established; but, upon the sixth day, all the evacuations ceased, attended with acute tenderness of the abdomen, which began to swell fast. The means adopted had not the slightest effect in relieving the symptoms, and the patient was considered past relief. At this period the idea suggested itself to me of cutting into the abdomen, and making an artificial anus, as the only hope left for the patient. I accordingly made an incision over the site of the former wound, and carefully opened the intestine, to the extent only to allow the tube of the stomach pump to be inserted, when there was an immediate discharge of flatus and some fæculent matter, and the patient expressed himself relieved. By the further use of the stomach-pump apparatus, I was enabled to extract a quantity of fæculent matter by the artificial opening, and after some hours the patient was completely relieved from the dangerous symptoms he was suffering from. The artificial opening was left open for two months, when the bowels again gave evidence of acting naturally. The artificial wound was not, however, closed till the 22nd of August, 1845, a week after the bowels appeared to act freely and naturally.

The patient from this time got well and strong, and was discharged to his duty, upon the 10th of October, 1845, since which period he has continued to perform all the duties of a soldier most efficiently, and without experiencing any inconvenience to his general health or constitution. On or about the 6th October, 1846, he died of inflammation of the brain, at Fort George, in Scotland. On dissection, the abdominal viscera, including the intestinal canal, appeared perfectly healthy; but on a minute examination of the needle should be used in the manner I have already alluded to.

Case 67.—In the year 1804, when in Halifax, North America, two soldiers were brought to me at the hospital, labouring under symptoms of enteritis; one from drinking a large quantity of new rum, the other without any very obvious cause. The first, a very strong man, was cured by depletion, carried nearly to the utmost extent. The second, Patrick Dogherty by name, died, under a combination of the best regulated means I was acquainted with, on the morning of the third day. He thought he had strained and hurt himself in some ordinary exertion, which he knew he was generally unable to undertake, in consequence of a previous attack of inflammation of the belly, some two years before, from which time he had suffered from constipated bowels. On examination after death, I found a portion of the ileum strangulated by a noose or bridle, which had been formed on the former occasion, and through which the gut had passed, and had become strangulated. The intestine above was greatly distended, the part was inflamed, and the bowels agglutinated to each other; the cavity contained a quantity of serous fluid and fibrinous shreds, indicating a high degree of inflammation. An operation at an early period might, I *then* felt, have relieved the patient, but I equally felt I had no grounds upon which I could have acted in doing it; for if ever an operation for opening the belly for the disentanglement of a piece of intestine, can succeed in Englishmen, it must be in the state of incarceration as distinguishable from strangulation, and before inflammation has set in with any degree of intensity.

Cases of extravasation, or of effusion, terminating by the formation of a sac, pouch, reservoir, or *foyer* surrounding it, whilst the rest of the cavity remains free from inflammation, are so rare in natives of our northern climates, that I am indisposed to infer that they do take place, except as very accidental circumstances. The different facts related however, should be borne in mind, and surgery should not be wanting in giving its aid, under all well considered and reasonable circumstances. It is easier to do nothing, than to think and to act.

The general treatment to be pursued in the acute period of all these cases of inflammation, has been sufficiently marked,—antiphlogistic to the utmost extent consistent with propriety, by bleeding, leeching, and cupping. The repeated administration of enemata, the early exhibition of mercury and opium, and subsequently of gentle aperients.

Continental Surgeons, and by pre-eminence Baron Larrey, who is followed on this point by most French surgeons, inculcate the necessity of enlarging the wounds made by a musket-ball in the wall of the belly, although the Baron is particular in confining it to the muscular parts; and M. Baudens, one of the latest writers on the subject, points out the additional tendency it gives to the formation of hernia, and exposes therefore the soundest reason for not doing it without an especial reason. When a slip of the muscular or tendinous structures interferes with the quiescence of the wound; when it is desirable to introduce a finger to make an examination; when it is necessary to divide a portion to allow the restoration of protruded parts, I apprehend no one will doubt the propriety of the direction. But when neither these nor any other good or sufficient reasons can be given for such an operation as that of enlarging the wound, (*debrider la plaie*) simply because it has been usual so to do, at the risk of making a large hernial protrusion instead of a smaller one, I do not understand why it should be done, and therefore, infer that it is unnecessary. It gives rise to some bleeding, but that is really nothing; it makes a cut instead of a hole, by which nothing essential is gained; and as this enlargement of the wound can always be accomplished when it may become necessary from a sufficient cause, I forbid, as far as my opinion may be deserving attention, such an interference, especially on the fore part or the sides of the abdomen.

When a musket-ball, passing across the abdomen, comes out behind through the thick muscles of the back, with perhaps a slit-like opening in the skin, through which some urine, and perhaps fœcal fluid or matter may also pass; such wound should be enlarged both superficially and deeply. There is here an object to be gained, and the operation is necessary. I have no objection to its being done when it is even supposed that these fluids or matters are likely to be soon, or ultimately discharged through it; as it is desirable that any secretions or effusions which cannot be evacuated by the natural passages, should have every reasonable opportunity offered of making their escape.

The ancient surgeons were devoted to various kinds of balsams, the inventions of André de la Croix, Arceus, &c. &c. which they spread on the wound, and over the abdomen; later continental surgeons to embrocations of oil of almonds, with camphorated spirit of wine, beaten up with whites of eggs: oil of almonds and tincture of opium, in equal parts, make a soft application to parts which are uncovered, or are protruded and cannot be returned; and an excellent one when the belly is distended and painful. Larrey has recommended the inside of the hide of a recently killed goat or sheep, of which I have had no experience.

# LECTURE V.

*Abnormal or artificial anus; Of rare occurrence in Great Britain and Ireland; Its surgery hitherto principally French; Mode of formation of artificial anus; The valve or septum in the orifice of the lower end of the bowel; The valve occasionally wanting; When the valve is absent, or of small size, the external wound may heal under moderate compression; Formation of the funnel-like pouch by the elongation of the adhesions between the intestine and wall of the abdomen; Desault's mode of treating artificial anus: Forget's introduction of a bent gum-elastic tube into the intestine, so as to compress the valve, and cause its removal; Schmalkalden's mode of destroying the valve by ligature; Practised successfully by Dr. Physick and Dupuytren; Dupuytren's forceps for the relief of artificial anus; Lallemand's case, in which he performed the operation, with the post-mortem appearances seven years afterwards; Modification of Dupuytren's forceps by Delpech, Liotard, and Blandin; Raybord's grooved forceps; Jobert's mode of applying the forceps; Autoplastic operations; Description of M. Velpeau's operation; Mr. Trant's propeller; Treatment prior to and after the operation for artificial anus; Wounds and injuries of the liver; Distinction between inflammation of the peritoneum lining the abdomen, and of that covering the viscera; Symptoms of wounds of the liver; Wounds of the gall-bladder fatal, unless it be adherent to the peritoneum from previous inflammation; M. Huttier's case of musket-shot wound of the gall-bladder, the ball being found in the gall-bladder two years after the receipt of the injury; M. Paroisse's case of sabre-wound of the liver; Dr. Roches' case of wound of the liver; Sir S. Barns' case of musket-shot wound of the liver, with injury of the rib, followed by repeated attacks of inflammation of the liver; Dr. Hennen's case of musket-shot wound of the liver with fractured ribs; Dr. Blicke's case of gun-shot wound of the liver; Mr. Bruce's case of gun-shot wound of the liver; Mr. Ryan's case of musket-shot wound of the anterior edge of the liver; Mr. Guthrie's cases of musket-shot wounds of the liver; Dr. Amedée Roux' case of stab of the liver; Removal of protruded portions of the liver; Blanchard, Dieffenbach, and Macpherson's cases; Comments on this practice; Wounds of the stomach usually fatal; Symptoms and treatment of simple wounds of the stomach; When the external wound is large enough to admit the wound in the stomach being seen, it should be brought together with the continuous suture; When the contents of the stomach are poured out through a small external wound, it should be enlarged, and the wound in the stomach closed; Treatment of musket-shot wounds of the stomach; Hevin's cases of stabs of the stomach; Case of suppuration of the stomach; Anxiety, a symptom generally attendant on dangerous wounds of the abdomen; Fistulous openings in the stomach, consequent on wounds of that viscus; Dr. Beaumont's case; Dr. Watson and Ploucquet's collections of such cases; Hevin's cases of knife swallowing; Hevin's case of the pig-tail passed into the anus; Circumstances requiring the operation of gastrotomy, and directions for its performance; M. Frizac's case; Incised wounds of the stomach rarely met with during the war; Gun-shot wounds not infrequent, and generally fatal; Injuries of the spleen usually fatal; Protrusion and extirpation of the spleen, through a wound in the abdominal parietes; Wounds of the spleen from stabs commonly fatal; Treatment of wounds of the spleen; Wounds of the kidney less fatal, but scarcely less dangerous than those of the spleen; Mr. Guthrie's cases after the battle of Waterloo; Fatal case of wound of the ureter or kidney, sigmoid flexure of the colon, and spine; Fatal case of wound of the kidney, and of the intestine; Wounds and injuries of the spermatic cord; Cases of muskct-shot wounds of the spermatic cord and testes; Removal of the injured testes; Treatment of consecutive hæmorrhage; Passage of a catheter as a point on which pressure can be made; Injuries of the urethra and their treatment; Wounds of the penis.*

*Abnormal or Artificial Anus.*—In some few cases, not only of wounds of the intestine, with or without loss of substance, but of strangulated hernia, the continuity of the bowel is not sufficiently re-established; the external wound remains open, and becomes indurated and fistulous, giving passage to the fecal matters, and rendering the sufferers very miserable. These cases are of rare occurrence among the hardy natives of Great Britain and Ireland, who seldom outlive the processes ending in mortification; and little has been consequently done, or even recommended in this country for the relief of this misfortune. Its surgery has been, until lately, entirely continental, and principally French, from the time of La Peyronie, Louis, and Sabatier, who first drew attention to the subject, unto Scarpa, Desault, and Dupuytren, who demonstrated a rational means of obtaining a cure.

When an intestine has lost a more or less considerable part of its substance, at a particular spot, and an artificial anus is about to be formed, it adheres to the peritoneum, around the inside of the external wound, although the adhesion is of little extent or width, and forms but a narrow barrier, for the protection of the cavity of the abdomen. The upper end of the bowel is more open than the lower, whose calibre is contracted in size, and is sometimes even difficult to find; whilst its opening is partially closed by a sort of septum extending across, or from where the two portions of a divided gut have come irregularly in contact with each other by their sides, without uniting in the first instance in their length; or from the falling in especially of the posterior part of the lower end, to which the upper has become united. The projection thus formed in the tube, is called by the French *eperon*, or *promontoire*, valve, ridge, or septum; it directs the fecal matter through the external wound, whilst it obstructs the passage into the lower part of the bowel. There is generally great difficulty in ascertaining the fact of the existence and exact situation of this valve during life, in distinguishing the upper from the lower end of the intestine, as well as the nature and extent of the adhesions by which the intestine is retained in its situation. If the absence of such a valve can be satisfactorily made out, and it is sometimes wanting,—the external opening may be successfully closed by compression, or by operation. If the valve should exist, its removal by a preliminary operation is necessary, and has been attempted in France with various, but somewhat doubtful success.

Where the valve is wanting, or of small size, or appears to offer little obstacle to the passage of the contents of the bowel from above, the external wound usually heals under a moderate degree of compression. When a portion of small intestine has been lost by mortification or otherwise, and the patient has recovered, with an unnaturally situated or artificial anus, the intestine, although at first in contact with the wall of the abdomen, is gradually in many cases, though not in all, retracted into the cavity—it has been supposed, by the dragging of the mesentery upon it, at the point of union of the divided extremities outside where the *eperon* or valve is formed; and it is said that this dragging has even led to the gradual disappearance of the valve, admitting thereby of the contents passing more readily from the upper part of the intestine into the lower, and consequently laying the foundation of a cure. This dragging on the intestine, or its movements under the different motions of the body, in some cases causes an elongation of the membrane formed under the adhesive process, by which the intestine is attached to the inside of the wall of the abdomen, in the same manner as adhesions are elongated between the pleura pulmonalis and the pleura costalis, and a sac or pouch is thus formed between the cut ends of the intestine and the fistulous external opening, which Scarpa was the first fully to demonstrate and explain, and which he called an *entonnoir*, *infundibulum*, or funnel. If then, in an old case, a small portion of the wall of the abdomen were removed, in the form of a V, the internal opening at the apex of the V, if small, would be made into a sort of funnel; whilst the outer incision would remove all the hardened fistulous parts; an operation which sometimes requires to be done, when the external opening is not free, and fecal matters have insinuated themselves between the aponeurotic parts, giving rise to abscesses, and other small fistulous openings in different directions. It is necessary to bear the formation of this pouch in mind, as well as of the valve, in order to understand the operations proposed for the relief or cure of this complaint.

If simple compression should fail in the first instance to prevent the passage of the feces which never can be thoroughly controlled, from the want of a sphincter, and the uncertainty of pressure, the method of Desault may be adopted. This consists in gradually dilating the external wound, so as to enable the operator to discover the open ends of the bowel, when a tent is to be introduced into the inferior end, and afterwards into the upper, being fastened by a thread passed around its middle. A pyramidal shaped pad is then to be placed over the opening, and compression made by bandage upon it, so as to press the whole inwards. The size of the tent is to be gradually enlarged, until the contents of the gut begin to pass downwards with ease, when a well adjusted pressure is to be made on the fistulous opening only, to prevent all oozing from it, until the internal parts have time to close.

It was proposed by M.M. Forget, and Columbe, in 1824, to introduce a gum elastic tube, a little bent, into the intestine, which would then press on the valve, and cause its removal. This operation was however found difficult of accomplishment, causing serious accidents when attempted, and was even fatal in its results, which led to its abandonment.

In 1798, Schmalkalden, in his Thesis entitled *Nova methodus intestina uniendi*, proposed to destroy the valve, by introducing a ligature through it, and by gentle tightening allow it to ulcerate its way out. The difficulty arose as to how the needle and thread should pass through its base, without doing other and serious injury. It was done successfully by Dr. Physick, of Philadelphia, in 1813, and Dupuytren tried the ligature with success, but he subsequently invented a pair of forceps, consisting of a male and female branch, to be applied separately, on each side of the valve, or *eperon*, to the extent of an inch, or an inch and a half at most, when they were to be closed by a screw, until they compressed the part between them sufficiently, to destroy its life.

The separation of the valve included within the forceps would take place by the usual processes of ulceration in its immediate proximity, and by adhesion of the parts external to the bowels, to those surrounding them. This inflammation however, did not always stop at the adhesive stage, and death has been the result, as well as a successful cure. Professor Lallemand* following the example set by Dupuytren, performed this operation on John Cyprien, forty-six years old, of Montpelier, who suffered from artificial anus, the consequence of strangulated hernia, and who died seven years after the operation. On examining the body after death,“ a portion of ileum was found adhering to the left inguinal region, in that of the cicatrix, by two slender columns; one, four lines long by two in width, contained a canal of communication between the fistula and the cavity of the intestine, which soon assumed the funnel shape, and was lost in the cavity of the bowels. When that was laid open, a slight prominence marked the place where the valve or *eperon* had existed before the operation for its removal." The intestine on the whole presented very little appearance of the injury it had sustained. Delpech, Liotard, and Blandin, have endeavoured to improve upon the forceps of Dupuytren, but they have not been able to remove its defects. M. Raybord invented an instrument like a pair of forceps, having a groove within, along which a cutting blade could be passed to divide the valve. M. Jobert directs the forceps to be applied for only forty-eight hours, and after a day or two's delay, to allow of new adhesions being formed external to the bowel, in consequence of the inflammation thus excited, the valve is to be divided by a pair of blunt-pointed scissors. It is said, that each of these methods has succeeded, but they must all be very dangerous in their application, that of Dupuytren not excluded, which has on the continent the greatest number of supporters. The reports of its success must, however, be received with some reservation, as unsuccessful cases have not always been recorded. When the external opening is principally in fault, the canal of the bowel being uninterrupted, and compression has failed, attempts have been made to fill up the opening by operation, and by the substitution of a new piece of integument from a neighbouring part. *Autoplasty.* The different attempts made in this way, have failed for the most part, and gave rise to the method of Mr. Velpeau, which having been successful, is tcerainly deserving of repetition. The operation is thus described by himself: — "I included and removed the whole of the fistula in a double elliptical incision, made obliquely towards the centre, so as not to include the intestine, or at most only the mucous membrane of its opening. I afterwards introduced four sutures, two lines from each other, taking care that neither should penetrate into the cavity of the abdomen, or that of the intestine. An incision was then made about two inches in length on each side of the elliptical ones, at the distance of about an inch and a quarter through the integuments and aponeurosis of the external oblique muscle. This enabled the sutures to bring the edges of the first or elliptical wound accurately together; the hollow left by the separated parts of the second incision was filled with lint, to insure its edges being well kept asunder. The operation was performed on the 13th November, 1835, and on the 18th it became necessary to cut the ligatures, in order to allow the contents of the bowel to escape, and the operation was supposed to have failed. The wound, however, gradually closed in, and the patient was discharged cured, on the 8th of February. The two external incisions relax the edges of the elliptical incision so much, that they are readily brought together by a gentle traction of the ligatures which may be lightly tied together. A retaining bandage is not necessary, but absolute rest in a recumbent position should be steadily enforced. An enema should be administered every morning for eight days, or till the ligatures come away.

Mr. Trant has invented an instrument he calls a propeller, for pressing back the *eperon*, an account of which he read before the Surgical Society of Dublin, on the 26th of April, 1845, which is reported in the Dublin Medical Press, of May 14th, 1845. He has used this in one case with complete success, the patient being previously in a very emaciated state, and likely to die from inanition. The instrument by its formation admits of being passed through the artificial anus, and of being placed on the *eperon*, at the bottom of the wound, where it can be retained for a considerable time without producing the slightest inconvenience. It does not whilst in the intestine offer any obstruction to the passage of the fecal matters flowing along the cavity of the tube. It acts as a forceps in retaining the anterior wall of the intestine in close contact with the posterior surface of the abdominal parietes, whilst the propeller is pressing back the *eperon* towards the spine; consequently the danger of separating the delicate adhesions in this situation is prevented, which might otherwise cause a fatal extravasation into the cavity of the abdomen. The paper is accompanied by a wood-cut representing the instrument, which was made by Mr. Reed of Dublin, and merits another trial, being apparently less dangerous than the other methods recommended in cases fitted for its use. Whatever may be the method employed for the cure of an artificial anus by operation, it cannot be doubted that the patient must be exposed to all the dangers which may result from inflammation, for which he must be prepared before-hand, and the symptoms of which must be met and subdued as they arise; or if this cannot be accomplished, the mechanical means, if any are used that can be taken away, must be removed, and quiet if possible, restored by their abstraction, and the treatment adopted. In successful cases a small aperture will frequently remain, constituting a fecal fistula, instead of an artificial anus. This will sometimes become irritable, inflame, ulcerate, or burst, discharging the solid contents of the bowel, although on the subsidence of the irritation the part under pressure usually returns to its former state.

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* Repertoire Generale d'Anatomie, &c. tome 7, page 133.

*Wounds and injuries of the liver*, whether incised or penetrating, occurring from blows or from musket-balls, are very serious, although not necessarily fatal. Some few persons recover altogether; some few with more or less of permanent disability. The remainder die during the first, or inflammatory stage; or in the secondary one, which follows, from the twelfth or fourteenth day, after the primary symptoms have in some measure subsided.

In all cases of penetrating wounds of the abdomen, the peritoneum must be injured, and undergo a certain degree of inflammation, which is marked by its peculiar symptoms; to which are added, those dependent upon any of the viscera which may be implicated by it. The peritoneum is not of itself a vital organ, in the true acceptation of the term, and only becomes so when it is intimately connected with one. Thus, the peritoneum lining the parietes of the abdomen, is by no means of so much importance in the animal economy, as the peritoneum covering the intestines. This inflammation, inertly treated, is usually fatal at the end of from twenty-four to forty-eight hours; whilst acute inflammation of the abdominal peritoneum may continue for twice forty-eight hours without causing death, and often becomes a chronic disease. When the inflammation of the peritoneum extends to the organ which it covers, the symptoms are combined, and in wounds, are characterized by the issue of the peculiar secretions or contents of the viscus. The symptoms which ensue after a wound of the liver, are those common to inflammation of the cavity of the abdomen, with the additional ones peculiar to the organ superadded; pulse often smaller, and less perceptible, than in peritonitis; discolouration of the skin, eye, and urine, amounting even to jaundice, although this is not an immediate symptom, neither is it always present. The pain is not confined to the part, but extends to the umbilicus, whilst the pain symptomatic of inflammation of the liver, viz., pain in the top of the right shoulder is early felt, and is often accompanied by cramps of the muscles of the arms, and numbness of the fingers. The usual symptoms of anxiety and depression are present, and the stomach shows, by its irritability, that it has partaken of the shock given to the system. The bowels are usually confined, but I have known blood passed from them, when it was not supposed that the stomach or intestines were wounded; the discharge from the wound is either of blood or bile, or both, mixed with a serous effusion, which afterwards becomes purulent. Wounds of the gall bladder are, as far as it is known, fatal; the effusion of bile which immediately takes place giving rise to inflammation, which, with other causes, destroy the sufferer at the end of a few days. If the gall bladder should adhere to the peritoneum from any previous inflammation, a wound in it need not prove mortal, as effusion would be avoided, and there is no reason to believe that an injury to this part would be otherwise more vital, than that of any other of the viscera of the abdomen.

CASE 68.—M. Huttier, of Chalons-sur-Marne, states that he cured a soldier of a wound made by a musket-ball, which entered the abdomen on the right side, and lodged. Two years afterwards, the man died of a affection of the lungs; and on opening the body, the ball was found in the gall-bladder, whch had no appearance whatever of having received any injury, there being no mark or cicatrix upon it. The man, during the course of the treatment, was jaundiced, and for a long time afterwards had a yellow tinge on his skin.

CASE 69.—Poroisse, in his *Opuscules de Chirurgie*, relates the case of a soldier, wounded in a duel, by a sabre, which made an opening between seven and eight inches long, in the wall of the abdomen, and another in the liver, two inches long, and half an inch in depth. The man lost a quantity of blood, and appeared to be dying. The wound, filled with coagulated blood, was cleansed of an enormous mass, by which the respiration and circulation appeared to be relieved. The edges of the external wound were placed in contact by compress and bandage, without suture, and the man laid on the injured side, to allow the discharge a free passage; he was bled four times within the first eighteen hours, acid drinks were allowed, enemata administered, and anodynes; the belly was fomented, the discharge was serous, yellow, and bloody. A tent was kept in the lower part of the wound. On the sixth day suppuration was established, and it became necesssary to support the strength of the patient; the colour of the skin and of the urine had been jaundiced from the first. After several vicissitudes the man gradually recovered, and on the twenty-sixth day was pronounced convalescent. M. Paroisse attributes his success in this case to the care he took to evacuate the extravasated blood in the first instance, and to prevent its diffusion in the cavity of the belly afterwards, by keeping the wound open. The skin for a long time retained its yellow tinge.

Cabrol states in his 18th observation, that Dr. Roches of Tarrascon had cured a soldier named Charles Pin, of a wound in his liver three fingers wide, and that he had the opportunity of verifying the fact by seeing the cicatrix after his death from a different cause.

Case 70.—Lieut.-General Sir S. Barns, when Lieut.-Colonel of the Royals, a man of a spare habit of body was wounded at the battle of Salamanca, by a musket-ball, which injured the cartilages of the false ribs, a portion of the rib being removed, and passed out, injuring the liver. A bilious discharge continued several weeks from the wound, and his life was saved with great difficulty. It was during this period that I saw him. The wound ultimately closed, and he was enabled to return to his duties, although suffering from a dragging pain and weight in his side, which any exertion increased. In the autumn of 1819, he was attacked in the most serious manner by acute inflammation; the pain in the right side extending over the stomach and down to the umbilicus was constant and acute, and increased on pressure; the pulse very small, indeed scarcely perceptible; the extremities cold and uncomfortable; the countenance depressed and anxious; bowels confined; stomach rather irritable. A number of leeches were applied, and other remedies administered. The constant pain, which was increased by pressure, could only be relieved by loss of blood, although every other symptom seemed to forbid depletion. Dr. Forbes kept his finger on the pulse, whilst I abstracted twenty ounces of blood from the arm, which caused a diminution of the pain, and gave relief for an hour, when it returned, and twelve ounces more blood were taken away with the most beneficial effect; a blister was applied over the part, and a dose of calomel and opium was repeated. Shortly afterwards he became tranquil; the extremities lost their coldness; and although the pain continued in a slight degree for several hours, and much soreness remained for many days, he quickly recovered. Two months afterwards, he had another and equally severe attack, in consequence of walking about two miles rather hastily, from which he was relieved in a similar manner. Whenever he bent his body a portion of the rib appeared to press in upon the liver, and often gave him acute darting pain; and one day, on pulling on his boot in haste, and with some bodily exertion, a third attack ensued. In order to prevent the bending of the body forward, and to confine the motion of the liver, which seemed liable to injury from the irregular points of bone which could be readily distinguished above it, stays, made with iron plates instead of whalebone, were adapted to his body, and from these he derived great comfort. The substance of the liver did not appear to be materially affected by the inflammation, but the treatment, as far as regards depletion, was not less vigorous than it would have been had the organ itself been more particularly implicated; the difference would have been, a more protracted chronic state of illness, and a longer medical treatment.

Case 71.—Lieut.-Colonel H. was wounded by a musket-ball, at Quatre-Bras, which entered behind, about two and a half inches from the spine, partially fracturing the eighth and ninth ribs, passing out between the seventh and eighth anterior in front, and about four and a half inches from the stern. The hemorrhage was great, and continued for three days. On the 11th, he was removed to Bruxelles; his pulse was then about 90, and hard; his countenance pale and sunk; his eyes glazed; his skin of a dusky yellow, and bedewed with a clammy sweat; the tongue foul; respiration difficult, and interrupted by frequent singultus. He had great sense of pain and weight in the region of the liver, but his severest complaint was an inability to remain in one posture, and want of sleep. He had occasional, but not violent cough, and expectorated some coagula of blood. On examining the posterior wound, I found a copious, glairy, yellowish discharge, mixed with air-bubbles, and some small streaks of blood; the anterior wound was nearly closed. He had been bled five times before his arrival, and the removal rendered the further loss of blood, to thirty ounces, necessary during the night.—12. Low and weak; pulse 81, and fluttering; tosses incessantly in the bed, and speaks incoherently; discharge very copious, thick, and of a deep bilious tinge; belly hard, and bowels confined; coughs up, with great difficulty, a tenacious yellow mucus, of bitter taste and offensive smell.—12th day. All the symptoms became aggravated, and he was bled to twelve ounces, which gave great relief. The edge of the wound, for about an inch round, was emphysematous. Up to the 24th of July, or the 37th of the wound, very little hope was entertained of his recovery; after which, he slowly improved. On the forty-first day, the discharge from the wound changed in a most remarkable manner, being not one-fourth in quantity, and having lost its bilious hue. A few spiculæ of bone came away from the posterior wound, and by the 1st of September he had quite recovered.

John Hennen, *Staff-Surgeon.*

In publishing this case, which I saw, it is just to the late Dr. Hennen to say, that, like all the other Staff-Surgeons at Brussels and at Antwerp, he offered to send me all the cases he had kept of wounds of the chest and abdomen. I suggested to him that he might derive advantage from publishing them separately, as Dr. Thomson was about to do, and, by this means, bring himself more under the observation of Sir James McGrigor, which advice he followed.

Case 72.—Corporal Macdonald, 1st battalion, 79th regiment, was wounded, on the 16th June, at Quatre-bras, by a musket ball, which entered the abdomen, splintered the eighth rib on the right side, passed through the liver, and was supposed to have lodged on the opposite side, as he says he felt the ball strike the left side, on which he was not able to lie for a long time. Lost little blood at the time; was dressed superficially, and arrived in Brussels on the 19th, labouring under considerable fever; pulse quick and hard; skin hot; tongue dry; respiration short, laborious, and painful; bowels confined since the 16th.—Venæsectio ad ℥xxxvj; magnes. sulph. ℥j. statim. For seven successive days the bleeding was repeated, from twelve to sixteen ounces each day, when a large, bilious, and purulent discharge took place from the wound, on which the inflammatory symptoms appeared to subside; and he continued in a quiescent state until the 30th of June, when bleeding took place from the wound, in the night, to the extent of twenty ounces, and ceased spontaneously. He then appeared to be doing well, until the 15th July, when the hæmorrhage recurred with so much fever, as to warrant twenty ounces of blood being taken from the arm, which was repeated next day. He took a saline cathartic every morning during the whole course of his illness. The bilious discharge ceased in the middle of August, and, on the 2nd September, he was discharged convalescent; the only material inconvenience he suffered from, being a shortness of breath on any great exertion.

W. F. Blicke, *Staff-Surgeon.*

Case 73.—Thomas Dobson, of the 2d Battalion, 2nd Foot Guards, received a gun-shot wound, on the 18th June, at the battle of Waterloo, which entered about three inches above the umbilicus, in the right side, wounding the liver, as was evident from the discharge of a fluid of a green colour, and in consistence resembling bile, and for which he had been bled. But little else had been done, until he came to Antwerp, on the 29th of June. He then complained of pain in the region of the liver, extending to the shoulder; countenance anxious; tongue white; eyes yellow; pulse quick and hard; belly tumid and constipated. Twenty-four ounces of blood were drawn from the arm, and a cathartic mixture, of infus. of sennæ and sulphate of magnesia, was desired to be taken, until some effect was produced. The abdomen was fomented, and simple dressings applied to the wound.

June 30.—Feels easier this morning; had evacuations during the night, and some sleep; pulse full, but soft; skin hot; says the pain has greatly diminished; countenance improved; eyes still yellow; tongue white; some cough; discharge of bile diminished. He was ordered a mixture of liq. ammon., acet., and antimonial wine every three hours, and the purgative mixture occasionally, to obviate costiveness.

July 1.—Discharge from the wound considerably abated, and consists of pus, mixed with a small quantity of dark fluid; tension of the abdomen subsided; some cough and expectoration, which he says has an unpleasant taste; eyes clearer; tongue clean; pulse 80, soft, and equable; the external wound is healthy, and granulating.

2.—His medicines were continued. Has some fever this morning; severe cough, with little expectoration; some sleep; tongue clean; bowels open; wound doing well; healthy pus is discharged. Ten ounces of blood were taken from the arm, and the mixture continued.

3.—Is perfectly free from febrile action this morning; and says he has no pain in the part, except when his body is erect; eyes clear; appetite capricious; some debility; bowels open; tongue clean. The mixture was continued.

4.—Continues to mend; wound improving; the ball has not been traced. Adhesive plaster was applied to the wound, the discharge having diminished.

7.—No particular occurrence has taken place during the last two days; the wound continues to do well; his general health improving gradually. He was desired to take some infus. of cinchona, acidulated with sulphuric acid.

Aug. 2.—This man continued to improve daily; his appetite gradually increased, and the wound was healed to within a quarter of an inch in circumference. The hospital being broken up, he was sent to Brussels this day.

Samuel B. Bruce, *Surgeon to the Forces.*
Antwerp, August 24, 1815.

Case 74.—Lieut. Edward Hopper, 1st battalion 38th regiment, was wounded, by a musket-ball, on the 9th December, 1812. It passed through the anterior edge of the liver, and, glancing round the ribs, was cut out about two inches from the spine.

On his being wounded, he could scarcely believe his shoulder was not the part affected. His pulse was rapid and intermitting; breathing hurried and laborious; and in a short time the tunica conjunctiva became yellow. He was *very largely* bled, and received an emollient injection (which produced no effect); and warm fomentations were applied to the abdomen, from which, and the bleeding, he received some temporary relief; but, in consequence of his removal that night to the rear, his symptoms were much aggravated on the morning of the 10th. He complained of acute pain over the whole abdomen, increased on pressure; vomiting; quick, hard, and wiry pulse (no pain referred to the wound). The bleeding was repeated ad deliquium; warm fomentations and enema also repeated; and he was ordered to take the saline mixture, with *very few* drops of tincture of opium in each draught, to allay the irritability of his stomach. On the following evening he appeared much better. Vomiting had ceased; and his pulse was considerably fallen, and less hard; pain of abdomen less general, and more confined to the seat of the wound; urine deposited a copious sediment, and appeared mixed with blood. On the 11th, after passing a very restless night, the pulse again rose; his abdomen became tense, but not very painful; and he made ineffectual efforts to stool. He was again bled, less largely than before, a large blister was applied over the abdomen, and an ounce of castor oil, with peppermint, was given immediately. On the following evening he was much relieved. The blister acted well, and the purgative gave him three copious stools, of dark and fœtid fœces. On the 12th, after having more rest than usual, he complained particularly of his wound, with twitching pains, referred to the right shoulder; and was ordered, during that day, one grain of calomel, with two of antimonial powder, to be taken three times.

Jan. 13.--Was free from pain during the day; pulse fuller, and less frequent; urine clear; tension of abdomen subsided. The calomel and antimony were continued; and, as his wound discharged freely, he took some light nourishment. From this day, a gradual amendment took place. The calomel was continued until his mouth became slightly affected; and,as his bowels were in general torpid, from the deficient secretion of bile, a mild purgative was given every two or three days, as occasion required; and an ounce of the infusion of calumba, with quassia, three or four times daily. His wound is now nearly healed; but, from the shattered state of his constitution, caused by this, and a previous dangerous wound he received at St. Sebastian, his recovery is likely to be very tedious, if ever perfect.

C. Ryan, *Surgeon 38th Regt.*

Bidart, near Bayonne, Jan. 7, 1813.

Case 75.—A soldier of the 4th regiment was struck by a musket-ball, at Albuhera, on the upper part of the right hypochondrium, over the liver, which came out behind, at a point immediately corresponding to that in front. Blood and bile were discharged from the wounds in considerable quantity, and his case was considered to be hopeless. Brought to me, at Valverde, the next day, he was largely bled several times,the wounds were simply dressed, and he was kept perfectly quiet, and his bowels gently open. The skin became of a yellow colour, his strength failed under the treatment, and he became thin, and looked ill. At the end of three weeks he was sent to Elvas, where he gradually improved, and was forwarded thence to Lisbon and to England, with his wounds healed.

Case 76.—An officer was wounded in one of the battles in the Pyrenees, by a musket-ball, which penetrated the outer part of the right hypochondrium, at the edge of the false ribs, and lodged. Blood and bile flowed in considerable quantity, his skin became yellow, the pain and swelling of the abdomen were considerable, and he was given over as lost. Under a very vigorous and careful treatment, he lingered for some time, and gradually recovered, so as to be sent to England, with a fistulous opening at the orifice of entrance. I examined the wound in 1817, three years afterwards, and found that a large blunt probe passed inwards towards the stomach, for the distance of five inches, where it ended apparently in a sort of sac. Purulent and bilious matters were constantly discharged from the wound; his countenance was sallow; his digestion bad; he suffered from constant uneasiness, if not pain and was altogether out of health. I saw him once annually for several years, and at last found that I could generally strike the ball with the probe; that he frequently, after an attack of pain and derangement, passed matter by stool, when the oppression and uneasiness about the wound ceased. I had hopes the ball would some day pass through the opening thus made, and had thought of enlarging the external wound, and of endeavouring to extract the ball by a long pair of forceps. He ceased at last to pay his annual visit, and I suspect he died in one of the attacks I have alluded to, now more than twenty years ago. This ball must have passed very close to, if it did not penetrate the gall-bladder.

I have never had the opportunity of extracting a ball from the liver during life, although I have removed some after death, at the end of several days. I have seen persons live, however, many weeks, into whose livers balls had penetrated; and I was acquainted with at least three persons who had been wounded through the liver, and in whom little subsequent inconvenience was occasioned.

Case 77.—Dr. Amedée Roux, called to a servant of Prince Demidoff, who was wounded by the thrust of a knife, to the extent of nine inches, found him in a state of syncope from loss of blood, and saw a cut on the liver of four fingers width, from which blood poured out most profusely. He immediately closed the external wound by four sutures, supported by long straps of adhesive plaster. Several bleedings followed from the part, and the bandages had to be removed as they occurred. On the evening of the next day, the skin assumed a yellowish tint, and peritonitis supervened thirty leeches were applied, followed by fomentations, which had the best effect. The abdomen continued distended, but less tender. The dressings were saturated with blood. On the third evening the bad symptoms returned, when the bandages were loosened to admit of a discharge of blood from the distended cavity, which continued all night, and relieved all the bad symptoms. On the fourth day this discharge continued, the bowels were opened as he lay for the first time by castor oil. On the fifth day he was better on every point. On the eleventh day the sutures were loose, and were removed. On the fifteenth day, having walked round his bed, the edges of the wound separated, and showed the edge of the liver, which rose up into the wound, but gave rise to no inconvenience, and the man was cured on the thirtieth day.—*Bulletin de l'Academie Royale de Médécine*, tome 10, p. 812.

Portions of the liver have been removed in some instances; in one case, related by Blanchard, in his *Anatomia Practica Rationalis*, 1688, a small piece of liver was removed by the forceps. Dying of fever three years afterwards, a small piece of the liver near the external wound, was found wanting. Dieffenbach gives a case in his Journal, in which a small protruded portion was cut off with scissors, without any bad consequences. Dr. Macpherson, in the *London Medical Gazette*, for Jan. 1846, has related the case of an Hindoo, a large piece of whose liver protruded through a wound an inch in length, made by a spear in the right hypochondriac region. A ligature was applied tightly around its base, and the piece cut off, rather than make such enlargement of the wound as might allow of the restoration of the protruded liver. The arteries bled from the cut surface, and required to be tied, and a double ligature was put through the stump of liver and tied on each side. This part was not pushed back into the abdomen, but allowed to remain in the wound. The symptoms were mild, the ligatures came away on the ninth day, and the man returned to his home in three weeks.

I consider these cases to be exceptions to the general rule, which directs the return of all protruding parts, and apprehend that the division of the external or tendinous expansion of the wall of the abdomen, without or with little enlargement of the cut in the peritoneum, would have facilitated the reduction. The retention of the part from which the piece was cut off, within the divided parts of the wound, was agreeable to the principles I have inculcated with respect to all cavities.

*Wounds of the stomach* are usually fatal, although some persons escape when these injuries are confined to its anterior and upper surface, and do not penetrate both sides, in which case effusion into the cavity of the abdomen, and consequent inflammation, can scarcely fail to ensue. Case No. 5, of Sir J. Elley, is perhaps among the simplest wounds of the stomach after which recoveries take place; and it is fortunate for the patient when they occur, that the stomach should be empty. If it should not be so, the contents may possibly be ejected shortly after the receipt of the wound, but it is not advisable to excite vomiting by remedies, or means adopted for that purpose. In a healthy person, the prospect of the stomach being emptied in the natural way, without extravasation taking place through the wound, is greater than if brought on by artificial means, and the vomiting is less likely to continue. In a perfectly quiescent state, the general compression of the contents of the abdomen by its walls, may prevent effusion under ordinary circumstances, and this state should be maintained as rigidly as possible. The apparent course of the wound indicates the probable mischief, which is confirmed by vomiting of blood, great anxiety, depression of countenance, a cold clammy skin, pain in the part, hiccough, and by a discharge of its contents, if the wound is sufficiently open to allow it; pulse low, and sometimes intermittent, if the collapse is great. If no effusion or passage of the contents of the stomach should occur, the external wound, if an incised one, should be closed by suture, and the patient kept in the utmost state of quietude, in an elevated position, leaning a little towards the wounded spot, the abdominal muscles being relaxed. Neither food nor drink should enter the stomach, although thirst should be allayed by wetting the tongue and mouth. The bowels should be relieved by enemata, and the belly fomented. Bleeding and leeching, as frequently repeated as the symptoms appear to require, must be carried to the greatest extent that can be permitted with safety.

When the external wound is so large as to enable the wounded stomach to be seen, the cut edges of the wound in it should be brought together by the continuous suture, as in the intestines; and the external wound should be closed in a similar manner, the end of the ligature on the wound of the stomach being cut off close to the stomach, and that organ being left perfectly free, with the hope that the thread will be carried into its cavity, whilst the outside adheres to the peritoneum opposed to it.

When the stomach pours its contents through an external opening, too small to allow of its being examined, it is desirable that this wound be enlarged, if a doubt be entertained of the passage being free. It is a sufficient reason for such operation to allow the opening in the stomach to be seen. It is very probable that effusion will take place into the cavity of the abdomen if it be not done, and the death of the patient will follow. It is very probable he will die if it be done; and, therefore, in such cases little has been hitherto attempted. I am of opinion, however, that, in the case I have last alluded to, a blunt hook may be sometimes introduced through the wound into the stomach, so as to keep it stationary whilst the external opening is carefully enlarged; and that it ought to be done in such cases, and the wound in the stomach closed, in the manner recommended. I have never had a case under my care in which I could have done this; but I have seen some die on whom it might have been done, and it deserves to be considered, when surgeons shall be in sufficient numbers on a field of battle to attend to such recommendations, and to the after treatment these cases require.

When the stomach is injured by a musket-ball, and its contents are discharged externally, the edges of the wound not being in a condition to unite, must remain open for several days. The person should be placed in the mean time in the most easy and comfortable position, which may enable the contents of the stomach to be readily passed out externally, if they shew any disposition to be thus evacuated. The external wound should be dilated as far as the peritoneum, if it should require it, so as to admit of the passage being direct, and symptoms must be awaited, and treated as they arise. If the patient should survive the first or inflammatory stage, he should be supported by clysters, composed of strong beef or veal broth, given five or six times during the twenty-four hours; and when it may be expected that the wound in the stomach has closed, or that the injured portion has adhered to the neighbouring parts, warm jellies and light broths may be frequently given, in small quantities, but solid food should be forbidden until complete recovery has taken place. I have seen inattention to this precaution in more than one instance prove fatal.

Case 78.—Hevin relates, in the first volume of the *Mémoires de l'Academie de Chirurgie*, a case treated by M. Coghlan, Surgeon-Major of the Hospital of Belle-isle, which deserves attention, from the quantity of blood lost, and the ultimate recovery of the patient from a wound by a sword, three fingers' width, below and to the side of the ensiform cartilage. Whilst M. Coghlan was preparing to probe the wound, the man threw up a quantity of food, beer, and blood. This was soon followed by a chamber-pot full of blood, which removed a sensation of weight he felt at the stomach. This vomiting of blood recurred four times, at an interval of two hours between each. Apparently about to die, recourse was had to a strong solution of alum, which was given to him after each vomiting of blood, and the bleeding was stopped after the third dose; a smaller dose was afterwards given to him, every half-hour. No blood passed with a motion he had in the night. The next day he was bled three times, and the alum was continued, the patient recovering on the seventieth day; having lost, by calculation, twelve pints of venous blood by vomiting, and taken two ounces and a half of alum during the period of its occurrence; on the efficacy of of which remedy great reliance seems to have been placed. Hevin afterwards says, he was informed by M. Carterat, that he was called to a peasant, struck by a knife in the epigastric region, which had made so large a wound as to enable him to draw out the stomach, the contents of which were discharged through a cut in its superior part. This wound he sewed up by the glover's suture, returned the stomach to its place, and then stitched up the external wound, applying over it a compress and bandage. The man was placed on his belly, and bled several times. The next day, the external wound had nearly united; no bad symptoms followed, and on the fourth day he went out to his business.

The symptoms of the participation of the organ, even when the inflammation extends to suppuration, when unaccompanied by a wound, are not always so distinct as to be pathognomonic.

Case 79.—A soldier quartered in the Strand barracks, in 1816, was taken ill after some irregularities, and was confined to bed one day, without his illness being reported. On the second day, he was seen by the usual medical attendant, and on the third, was sent to the York Hospital, Chelsea, complaining of intense burning pain at the stomach and umbilicus, always present, and increased on pressure, although sometimes more violent than at others. The stomach rejected everything, the bowels were constipated, the pulse quick and small, countenance expressive of great anxiety and pain. On the third day after his admission he died, active depletion, and all the other usual remedies having been employed in vain. On opening the body, I was surprised to find no marks or signs of inflammation on the intestines near the umbilicus, to which the greatest pain had been referred, and to see the stomach much enlarged, of a whitish colour, and so changed from its natural appearance, as to resemble the thick smooth part of boiled tripe. On cutting into it, I found it nearly as thick, in consequence of the cellular membrane between its coats being loaded with matter resembling pus, which could be easily pressed out, leaving a honey-combed appearance, in addition to the universal thickness of the stomach, which was evidently in an equable state of suppuration throughout. Portions of this stomach I gave to the late Dr. Hooper, in whose collection, now in King's College, and in that belonging to the Medical Department of the Army, at Chatham, the only known specimens of this disease were at that time to be found. If there be a symptom more generally observable than another in all cases of dangerous wounds of the abdomen, it is anxiety—it is not only of the mind, as shewn by the countenance in a very expressive manner, but of the body, as demonstrated by great uneasiness. In some cases it is a more certain sign than the pulse of great mischief; in others more distinctive than pain, which is sometimes referred to a part unaffected; and is in all indicative of the necessity of a corresponding attention on the part of the practitioner; for while it is present, although other symptoms be mild, the patient is in imminent danger.

Fistulous openings have been known to follow wounds of the stomach, and to remain for years. The case related by Dr. Beaumont of the American

Army, of C. Martin, who in 1822 received an extensive wound in the stomach, which became fistulous, admitting of a variety of most interesting enquiries being made into the process of digestion, is remarkable. The stomach has been opened surgically, and with success, for the extraction of knives, which had been foolishly swallowed for bravado or gain by the sufferers.

Dr. Watson in a Memoir on Organic Obstructions of the Œsophagus, published in the eighth volume of the American Journal of the Medical Sciences for 1844, has collected many instances of fistulous openings into the stomach, and of incisions made into it accidentally or purposely for the removal of knives, &c.

Ploucquet in his *Bibliotheca* has enumerated near a hundred writers under the head of "Pantophagus," who have related such cases, and as many more under the heads of Vulnus and Ventriculus. Hevin in the first volume of the Memoirs of the Academie de Chirurgie, has related some of the most interesting cases of those who had swallowed knives, &c., by design or by accident to his time. One gentleman swallowed a silver fork, another a silver spoon, a third fifteen gold medals, all of which after a certain lapse of time were discharged per anum. Of the *cultrivores* and others, whose stomachs were opened and the knives removed with success, there are many instances. The most ridiculous story of the whole of those which Hevin has collected, is an instructive one. Some young students desirous of punishing a young woman who had offended them, cut short the hair of the tail of a large pig, and when frozen hard, forcibly pushed it up her anus, leaving a couple of inches only hanging out of the small end or tip. The hairs having been cut short, caught in the gut when the tail was attempted to be drawn out, and gave her inexpressible pain. The most serious symptoms followed during six days, and every attempt having failed, Marchettis was applied to. He prepared a hollow tube, two feet long, and large enough to receive the thickest part of the pig's tail, to the end of which he fastened a strong waxed cord, which he drew through the tube. He carefully introduced the tube into the anus, pushing it over the pig-tail, until he drew the whole of it into the tube, which he then brought away including the tail, to the great relief of the sufferer; a mode of proceeding which has lately been brought forward as new and important, with respect to introducing one catheter over another into the bladder.

The necessity for an operation so grave as that of opening the stomach, must be shewn by the presumed impossibility of the foreign substances being dissolved, or of their passing out of it by any other means, whilst the continued distress they occasion more than equals the risk which is likely to be incurred. The offending substance ought to be felt through the wall of the abdomen, and the incision for its removal should be made between the recti muscles in the linea alba, unless the foreign body has actually pierced the stomach, and is felt to the outside of the rectus muscle, at which part the incision ought to be made obliquely in the direction of the fibres of the external oblique muscle, all bleeding vessels being secured before the peritoneum is opened. This being accomplished, the protruding body should be extracted by such enlargement of the opening in the stomach as may be actually necessary. M. Frizac of Toulouse is stated by Baron Larrey to have done this successfully; but when the substance does not protrude, although it can be felt through the wall of the stomach, it will be advisable if possible, to draw it towards the upper or smaller curvature of the stomach rather than to the lower, avoiding the coronary vessels, and taking a medium distance for the opening from the cardiac orifice, and thereby such advantage as may be derived from gravitation. The wound in the stomach should be united by the continuous suture, and the external wound should be closed in a similar manner. The patient ought to be kept in bed, in an easy erect position.

Incised wounds of the stomach were rarely met with during the Peninsular war. Gun-shot wounds were not infrequent, and were generally fatal; so much so, that whilst Baron Percy estimates the successful cases as four or five out of twenty, I am not disposed to calculate upon more than half that number.

*Injuries of the spleen* have been usually fatal, from hemorrhage filling the general cavity of the abdomen, especially when they have arisen from rupture of that organ, which I have several times seen occur in consequence of falls, or from blows from cannon-shot, which have not opened into the cavity or exposed the viscus. Wounds from musket-balls have, for the most part, destroyed the sufferers, either from hæmorrhage or from inflammation. I have not seen nor heard, during the Peninsular war, of a wound in the abdomen through which the spleen protruded, and the patient recovered. Instances have occurred in which this part has been removed in man after its exposure by injury. A case is said to have taken place after the battle of Dettingen, in which the spleen, covered with dirt, was cut off, and the patient recovered. In another case, the spleen, found without the wound at the end of twenty-four hours, was cold, black and mortified. The surgeon placed a ligature above this part, and cut off three inches and a half of the spleen; a large artery was tied, and the remaining portion of the viscus was returned into the cavity of the belly, the ligature hanging to it, and the patient got well.—*Fergusson in Phil. Trans.* vol. xl. 1737-8.

Wounds from stabs with a bayonet, or a sabre or long pointed sword, are commonly fatal, either from hæmorrhage or from inflammation. I have, however, seen cases of wounds from stabs and from musket-balls which ought to have injured the spleen, from which the sufferers recovered; and I have seen accidentally after death, cicatrixes in the spleen corresponding to external marks, indicative of a former wound. The treatment in all such cases should be to encourage the discharge of blood from the part, in the first instance; then to close the external wound if an incised one, to place the patient on the injured side, and to subdue all unnecessary inflammation, by bleeding, leeching, absolute rest, and starvation. The application of warm fomentations, where an oozing of blood may be expected to take place, cannot be recommended, and cold should be substituted, if agreeable to the feelings of the patient. When the blow or wound does not cause the death of the individual by hemorrhage or acute inflammation, a chronic state of disease may supervene, which, if not duly combated, will ultimately destroy him. The early administration of calomel and opium, and the repeated application of blisters, will in these cases as well as in those of the liver, be of the greatest service. Effusion, or suppuration may take place as well as in those cases which have been noticed, when other of the viscera have been injured; and although instances of such terminations are not recorded, it does not follow that they have not taken place.

*Wounds affecting the kidney* have been less fatal than those of the spleen, although they are scarcely less dangerous, from the complications by which they are attended; the successful cases on record are not numerous, and the practice to be pursued can only be general. The results, when not fatal, have been for the most part unknown, from the patients either lingering on, or recovering after they have been discharged from the service. I saw two cases after the battle of Waterloo, of this nature. In one, the ball had passed through the abdomen, entering a little below and to the left of the umbilicus, and coming out behind nearly opposite, and close to the spine. No fecal matter was discharged from the front wound, but some came though the posterior one, accompanied by a small quantity of urine, indicating a lesion of the kidney, or ureter at its upper part. The symptoms at first severe, had subsided under proper treatment, and there was every probability that the sufferer would eventually recover, although I was unable to trace the case, after the man left Brussels. In the other, pain was principally felt in the testis, and the spermatic cord of the side injured.

Case 80.—Charles Quin, of the 1st battalion, of the 11th foot, was wounded at the battle of Toulouse, on the 6th of April, 1814, by a musket-ball, which entered on the right side at the end of the false ribs, and came out at the opposite side of the back, thus passing across the abdomen diagonally. He was supposed to be killed, and was left as a hopeless case, until he began to revive the next day, and to complain of pain, when he was bled largely and relieved. The urine was mixed with blood which passed also by the bowels, indicating a wound of both bowels and kidney. The antiphlogistic treatment was vigorouly continued until the 13th, when he was brought into the Minime Hospital in the town, from the hospital in the field, where he lingered until the 23rd., and died seventeen days after the receipt of the injury.

Dr. Hennen has related the case of an officer, who was wounded in the kidney, whom I saw. I transcribe the essential part, as it was reported to him, because it contains subsequent matter, with which I was unacquainted.

Case 81.—An officer was wounded on the right side, on the 9th December, 1813, the ball being cut out behind; his case was considered hopeless. An hour afterwards, on being moved to the fire, he desired to make water, and then passed what appeared to him to be a quantity of blood. Carried to the rear, on a waggon, for three leagues, he suffered beyond description; passed bloody water again, and on his arrival in quarters, was bled, and had an enema administered. He then became delirious; was bled several times, had blisters applied to the abdomen, suffered from pain at the top of the right shoulder, and took no other nourishment but tea for fourteen days. He gradually recovered, and at the end of seven weeks, was sent to England. After remaining some time in London, he joined the depôt of his regiment. In consequence of this exertion, he suffered an attack of fever and peritoneal inflammation; and a tumour formed in the site of the posterior wound, which was opened, and discharged several ounces of matter, of an urinous odour. Another abscess formed, and was opened. During this time, he suffered great pain, became greatly emaciated, the urine diminished in quantity, with the frequent calls to pass it. He lingered in this state until the end of July. The flow of matter from the wound was great, and of an urinous smell. The desire to make water was incessant, passing only by drops, and bringing him to a state of frenzy; the discharge from the wounds, which had been lessening for two days before, suddenly stopped; the pain and pressure of urine became intolerable; he remained at last in a state of the greatest torture for about three minutes, when, during an effort, a burst of urine took place, coloured with blood, forcing out with it a hard lump, shaped like a short thick shrimp, three quarters of an inch long, which proved to be next day, when examined, the cloth which had been driven in by the ball. It must have passed from the pelvis of the kidney, or the ureter, into the bladder. It was hard, was covered by a black crust, and was thought to be a stone when passed. It could not, however, have been long in the bladder, or it would have been covered by the triple phosphates, and have formed the nucleus of a calculus, requiring to be removed by operation.

Case 82.—Le Capitaine Negre, of the French Infantry of the Line, was struck on the left side, above the hip, at the battle of Albuhera, by a musket-ball, which went through the upper part of the sigmoid flexure of the colon, and came out behind, injuring apparently the fourth and fifth lumbar vertebræ. As urine came through this opening, the ureter or lower part of the kidney must have been wounded, and as he had lost the use of one leg, and much of that of the other, the spinal marrow must also have been injured. He was left on the field of battle, supposed to be about to die, and was brought to me, to the village of Valverde, three days afterwards, in the most distressing state. The inflammatory symptoms had been and were severe; they were however subdued, but his condition from the want of almost every comfort, common to him and all others, after that the bloodiest battle in British history, was to be deplored. The pain he suffered on any attempt to move him was excessive, the discharge of feces from the anterior wound, and of urine from the posterior one, and by the usual ways, rendered him miserable, and he at last implored me to allow the box of opium pills, of which one was given at night to each man who stood most in need of them, to be left within his reach, if I would not kindly do the act of a friend and give them to him myself. He died at the end of ten days, after great suffering, constantly regretting that our feelings as christians, caused their prolongation. I have had several cases somewhat of a similar kind, but without injury of the spine, at different times, after the battles in the Peninsula, and some few have apparently recovered, after a lapse of time, by the efforts of nature alone, without any specific treatment.

When the ureter is wounded, comparatively little blood is passed with the urine through the urethra, and this remark will extend to the pelvis of the kidney, after the first days; when blood continues to flow, tinging the urine for a longer period, the vascular part of the kidney has been injured.

Case 83.—A soldier of the 57th Regt. was wounded at the battle of Albuhera, by a musket ball, which entered above the hip on the left side, and lodged; he passed bloody urine for four or five days, repeatedly, and in small quantities; he had lost the use of the left leg, and suffered great pain; blood also passed with his motions, indicating a wound in all probability of the large intestine. The flow of urine by the urethra at last ceased, the bladder became distended, and his sufferings induced me to pass a catheter, which drew of a quantity of very bloody urine, mixed with coagula. He died the day afterwards. The urine was probably secreted in a great measure by the uninjured kidney. I have never had a case of wound of the kidney, in which there was either time or opportunity to make those examinations of the urine, which modern science would require in a well conducted treatment.

*Wounds of the spermatic cord*, are of infrequent occurrence, and rarely lead to fatal, although often to inconvenient consequences.

Case 84.—On the heights of Rolica, in the first battle which took place in Portugal in 1808, a soldier of the 29th Regiment, was wounded by a musket-ball, which passed from the outer and lower part of the buttock on the left side, and came out at the inner and upper part of the thigh, passed across the upper part of the scrotum, divided the spermatic cord, and slightly injured the penis in making its final exit. Little inflammation followed, although a good deal of ecchymosis took place, and some swelling of the testes ensued, which ultimately subsided, and he recovered, with the presumed loss of the function of the organ on that side, which gradually diminished in size.

In another case at Talavera, nearly similar, a small ball passed through the testis, at its upper and anterior part, and went through the anterior part of one corpus cavernosum. The patient recovered without much inconvenience, beyond a little loss of substance at the part injured. The bleeding was not material in either of these cases, nor was it great in any others that I have seen.

Case 85.—John Dunn, 1st battalion, 79th regiment, was wounded on the 16th of June, at Quatre Bras, by a musket-ball, which passed through the scrotum, testicle, and upper part of the thigh or groin of the left side, and came out behind through the nates. He was bled, and treated antiphlogistically, no urgent symptoms followed, and he was discharged cured on the 31st of July.

Case 86.—A private of the third division was wounded at the affair of El Boden, in front of Ciudad Rodrigo, by a small musket-ball, which passed through the testis and scrotum, and through the back part of the opposite thigh. Carried to Sabugal, he remained under my care a month, under very moderate treatment, and suffered but little from inflammation, when he was sent to the rear nearly well.

I have removed the bruised and shattered remains of a testis and epidydimis to expedite the cure, and I have been obliged to do so at a later period, in consequence of the wounded portion becoming enlarged and diseased. These occurrences are rare; the wound in the testis usually heals kindly, the portion which remains, however is probably of little use, although the patient does not like to lose it.

I have not had occasion to tie an artery even when the penis has been as good as amputated. If bleeding should take place in the progress of the cure, a large catheter should be introduced into the urethra, as a point on which pressure may be made laterally; for I am not aware of any other use it can be, unless the urethra is also torn, when a moderately large catheter should be kept in it permanently, if it can be borne, to aid in the healing of the surrounding parts, with as little contraction as possible of its canal. When the corpus spongiosum is carried or sloughs away with the urethra, there is usually some injury done at the same time to the corpora cavernosa, and the part becomes contracted, and curved when distended. I have not seen any of these cases since the introduction into practice of the methods which have been recommended by Dieffenbach and others, for the formation of a new urethra, by borrowing from the neighbouring parts; but several that I have seen might certainly have been benefited by such treatment.

Case 87.—A married soldier, of the 29th regiment, was wounded on the heights of Roliça, in August, 1808, by a small musket-ball, which went through both corpora cavernosa, from side to side. The man suffered very little inconvenience, and the wounds healed very well. He seemed to consider the injury as of no importance to himself, but had some idea there might be a difference of opinion in another party. There is usually a deficiency of substance at the part, and sometimes an inconvenient curve or twist, such as often takes place when the corpora cavernosa and the corpus spongiosum are ruptured from other causes.

I omitted to state at page 50, before Case 68, when noticing wounds of the gall bladder, that I have seen several cases of wounds of the liver in which the gall-bladder was wounded, but they all proved fatal. In a French cavalry soldier, wounded at Waterloo, by a musket-ball, in the right side of the abdomen, there was a presumption that the gall-bladder was wounded, as well as the liver, from the great discharge of bile which took place from the opening of exit, situated a little to the inside of its usual position. The inflammatory symptoms were not very severe, and it is presumed that adhesions early formed, preventing effusion into the cavity of the abdomen. The patient slowly improved, and, was sent to France, with the wounds discharging, but in tolerable health, and likely to live. This case was treated by Staff-Surgeon Lyons, at Brussels.

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# LECTURE VI.

*Wounds of the pelvis from musket-balls; Of common occurrence, and generally, but not immediately fatal; Fistulous openings connected with the bones, a consequence of these wounds; Paralysis of one or both limbs, or parts thereof, a symptom indicative of the mischief caused by the wound; Complete paralysis occurs when the spinal marrow is injured; The paralysis incomplete, when the nerves only are injured; Balls lodging in the bones of the pelvis should be removed, if it can be done with little comparative danger; Cases of musket-ball wound of the pelvis, the ball lodging; Case of musket-ball wound of the pelvis and spinal column; Baron Percy's case of musket-shot wound, injuring the spine; Mr. Guthrie's case of musket-ball wound of the pelvis, with injury of the spine and bowels; Dr. Blicke's case of musket-shot wound of the pelvis, with division of the external iliac artery; Case of musket-shot wound of the pelvis, with division of the common iliac artery; Consequences of the non-removal of balls, that have lodged in the pelvis; La Motte's case of musket-ball lodged in the pelvis, extracted on the forty-fifth day after the receipt of the wound; The situation of the ball should be ascertained, before deep and long incisions are made for its extraction; Case of fatal cannon-shot wound of the pelvis and spine; Mr. Kennedy's case of extensive injury of the loins and pelvis from a large shot; Dr. Adolphus' case of musket-shot wound of the abdomen, with injury of the spine; Wounds of the bladder, not necessarily fatal; Recovery may take place almost by the efforts of nature alone, when the wound is in a part not covered by peritoneum; Dupuytren's experiments on the injection of fluids into the cavity of the peritoneum from the tunica vaginalis; Small effusions of urine supposed in some cases to be confined in a foyer; Wounds of the bladder where covered by peritoneum, the urine not being effused into the cavity of the abdomen; Consecutive accidents; Employment of the catheter to drain off the urine, and thus prevent its effusion into the abdominal cavity; Treatment of the consecutive inflammation; The inflammatory swelling and separation of the sloughs obstruct the passage of urine through the wounds; Advantages of the permanent use of the catheter; The operation required, when the neck of the bladder, or the prostatic part of the urethra has been divided; Baron Larrey on the treatment of wounds of the bladder; Case of musket-shot wound of the pelvis, with injury of the bladder, followed by the discharge of a piece of jacket from the urethra; Case of musket-shot wound of the pelvis, with injury of the sciatic nerve and bladder, followed by prostatic abscess; Case of musket-ball wound of the bladder and intestine; Mr. Bruce's case of musket-ball wound of the bladder, followed by urinary fistulæ; Mr. Boutflower's case of gun-shot and bayonet wounds of the bladder and intestines; Dr. Waltz's case of pistol-shot wound of the bladder; Fatal case of musket-shot wound through the pelvis, involving the bladder and intestines; Fatal case of musket-shot wound of the pelvis and bladder; Mr. Douglas' case of musket-shot wound of the bladder, followed by the discharge of a piece of cloth from the groin, and another from the right nates; Dr. Gordon's case of musket-shot wound of the bladder, the orifices of entrance and exit becoming fistulous; Baron Percy's case of pistol-shot wound of the bladder, followed by a tumour in the perineum; Case of musket-shot wound of the bladder; Case of musket-shot wound of the bladder and rectum; Serious consequences which occasionally follow musket-shot wounds of the bladder; Fatal case of musket-shot wound of the prostatic part of the urethra, or of the neck of the bladder; The plan of treatment requisite in such cases; Mr. Guthrie's case of musket-ball wound of the bladder, the ball lodging in that viscus, and forming the nucleus of a calculus; afterwards removed by the operation of lithotomy; M. Langenbeck, Baron Larrey, and Mr. Cline's cases of the extraction of a ball from the bladder; Bonnetus' case of passage of a small ball by the urethra; Dr. Hennen's case of musket-ball wound of the bladder, followed by abscess of the thigh; Wounds of the rectum; Cases of musket-shot wound of the pelvis and rectum.*

Wounds of the pelvis from musket-balls, injuring its contents, are of common occurrence, and although frequently fatal, they are not usually so at the moment, and often permit of a considerable length of treatment before they destroy the sufferers, or admit of their recovery. In many instances fistulous openings through the bones remain for years; and in a great number the ingenuity of the surgeon is often at work, to discover in what manner important, nay vital parts, have escaped injury. The orifices of entrance and of exit of the ball lead to little information. It is only from the absence of paralysis, or of hemorrhage, or of those signs which indicate the lesion of any of the organs contained within the pelvis, that the surgeon can form an estimate of the evil which has been committed; and even when parts of the greatest importance are injured, such as the bladder or the rectum, the general symptoms are occasionally of little moment.

Paralysis of one or of both limbs, or of parts of them, which is not uncommon at the moment of injury, indicates the nature of the mischief; in some cases it comes on at a later period of time.

When the paralysis is complete, which it rarely is, unless the spinal marrow is injured in the loins, the functions of the bladder and of the rectum are implicated, and there is little pain. When the nerves only are injured, the paralysis is not complete; it usually affects one side more than the other, is a numbness rather than a paralysis, accompanied by severe pain, sometimes in the seat of injury, but more usually extending to the thigh and to the extremities of the nerves in the foot. I was last year consulted in a case of wound in the last dorsal or upper lumbar vertebra, of several years standing, from a pistol shot, in which the paralysis of both limbs was complete. The patient had a great desire to have the cicatrix opened, and the ball followed and extracted, and would willingly have submitted to such operation, but he could not find any one in London or Paris willing to attempt it.

When a ball appears to cross, or to pass even from side to side of the pelvis, it is not always easy to say whether it has penetrated the cavity or not, until symptoms indicative of such injury appear, and the less done to such wounds the better. When a ball enters, strikes a bone, and lodges, it is very desirable to ascertain its situation, in order that it may be at once removed, if it can possibly be done with little comparative danger; for balls which pass through these flat bones, or lodge in them, may often be removed, and the comfort of the patient assured, by a timely operation, performed by a skilful surgeon, instead of proving the source of much torment and misery for many years, by their being allowed to remain.

Case 88.—Colonel Wade was wounded at the battle of Albuhera, in 1811, by a musket-ball, in the lower part of the iliac region, on the left side: it passed through the ilium, and was supposed to have narrowly avoided opening into the cavity of the abdomen. It could not be followed beyond the bone, and appeared to have lodged on the outside of it, under the gluteal muscles. The inflammatory symptoms were subdued, and he gradually recovered his health, some pieces of bone having come away from time to time. A small fungous protrusion and discharge continued from the wound for several years, with a certain degree of pain, and of occasional lameness in the leg and thigh. The wound closed of late years, sometimes for a few months, and re-opened after an attack of pain, with great lameness, and swelling of the hip, and a discharge of matter from the original site. An abscess at last formed under the gluteus maximus, and was opened at its anterior and lower edge. This gave great relief, and prevented the irritation of the upper and anterior original wound, the matter finding a more ready passage. I often assured him I could distinguish the ball very deeply seated, and in the summer of 1846—thirty-five years after the receipt of the injury, it had descended so far that I passed a probe under it, at the distance of two inches and a half from the lower opening. He was to have come up as early as his duties would possibly permit, in the spring of 1847, to have had it removed, when he was suddenly cut off by apoplexy, to the great regret of all who knew him.

Case 89.—Lieutenant-Colonel, now Lieutenant-General Sir Hercules Pakenham, was wounded, at the assault of Badajos, by a musket-ball, April 6th, 1812, which deprived him of the use of the thumb and little finger, and partially of the hand, and by another which struck him on the right iliac region, passed in just below Poupart's ligament, and outwardly through the ilium. Eight pieces of bone came away at Elvas, and eleven more, in 1813, in London. He went to Barèges in 1814-15-16-17, with the hope that the ball might be loosened, and removed; but in vain, it never could be found. A small quantity of inoffensive glutinous matter, sometimes streaked with blood, is discharged from the seat of the injury: at times the wound is painful and very troublesome, for a week or ten days together; after which it becomes quiet, and during this period little inconvenience is felt in the limb.

Case 90.—Sir J. M. Wilson, now of Chelsea Hospital, was wounded in seven different places, and by three musket balls, on the left hip, at the Chippewa, near the falls of Niagara, on the 5th July, 1814. One, which struck him a little before the trochanter, passed upwards and through the ilium, from which several pieces of bone came away on four or five different occasions, and lodged against or in the spinal column, which rendered the left leg quite powerless, and impaired the power of the right. He fell. Shortly after an Indian warrior came up, placed his foot on his neck, drew out his scalping knife, seized his hair, and was in the act of beginning to scalp him, when a stray shot passed through his chest, and laid him prostrate by the side of his proposed victim, who thus happily escaped. The numbness and inability to put the limb to the ground continued from eighteen months to two years, during which time he was on crutches. After this time he gradually recovered, always suffering more or less. The pain in the back is often most excruciating, coming on without any apparent cause, except perhaps change of weather. He limps after walking a couple of miles, and if exercise is continued, pain ensues. He married ten years afterwards, has several children, and is obliged to lead a very regular quiet life, without which he breaks down. The great suffering he experiences, at the end of thirty-one years, is, however, from the pain in the back, a sense of coldness in the left leg, and numbness, accompanied by pain in the course of the nerves. He is equally sensible to heat in a close atmosphere, which he is obliged to avoid. The alvine, and urinary secretions, &c., have always since the wound, been impaired, or deranged. He is troubled with painful affections, and a train of nervous feelings of the whole system, attributable to the injury received.

Case 91.—Baron Percy, in his *Chirurgien d'Armée*, seconde partie, p. 234, says: that a young Irish soldier was wounded at the battle of Fontenoy, by a musket ball, which, after breaking the spinous process of the third lumbar vertebra, lodged in the side of its body, causing paralysis of the lower limbs, and of the bladder. M. Giraud dilated the wound upwards and downwards, and removed the splinters of the spinous process. The attempt to remove the ball failed; the wound was dressed simply; he was bled five times, and poultices applied, until an abundant suppuration was established. The ball was then moved, and ultimately extracted by the screw, after which the paralysis gradually disappeared, and the patient recovered.

Case 92.—A soldier, of the 4th division of Infantry, was wounded at the battle of Salamanca, by a musket-ball, which entered immediately above the right ilium, passed across, and made its exit nearly opposite on the left side, going nearer to the back than to the wall of the abdomen. He was supposed to be killed, but had gradually recovered a little life, when brought to me to the field-hospital some hours afterwards. The belly was swelled, generally tympanitic, and some hemorrhage had taken place from the wound of entrance, the leg of which side he was unable to move. On reaction taking place, he was bled repeatedly, and treated antiphlogistically, with the aid of calomel, opium, and antimony. On his removal to the San Domingo Hospital, enemata were administered, and on the sixth day the bowels were relieved naturally. A small quantity of fecal matter was passed for several days with the discharge from the wound, but this gradually ceased, and the man ultimately recovered without any particular defect except weakness, and occasional pain and derangement of bowels, on any irregularity.

The following is the most serious injury of the pelvis I have known, not causing immediate death.

Case 93.—John Bryan, 1st light battalion of the King's German Legion, was wounded on the 17th June, near Quatre-bras, by a musket-ball, which entered at the groin, and made its exit behind, at the back. Transported to Brussels, he was seen for the first time on the 22d by the Staff-Surgeon, who found the foot and leg in a state of mortification. The countenance had [illegible] cadaverous appearance; pulse small and weak; some nausea and retching. Wine, and other stimulants were freely given, and he rallied a little on the 23rd and 24th. On the 25th, the stomach rejected everything, except brandy and opium. On the 26th, a line of separation seemed to be about to form between the dead and the living parts, although he was evidently failing; he died on the 28th, eleven days after the receipt of the injury. On examination after death, the ball was found to have completely divided the external iliac artery; about a pint of coagulated blood, mixed with some excessively fetid pus, was collected in the pelvis; both ends of the artery had receded considerably from each other, and a coagulum had formed in each, which was easily squeezed out, the orifice of the upper end only being a little contracted. There were signs of some peritoneal inflammation having taken place; the intestines had not been wounded, and the ball, in passing out, had splintered the upper edge of the back part of the ilium.

Thos. Blicke, *Staff-Surgeon.*

General Sir Edward Pakenham was killed on the spot, at New Orleans, by hemorrhage, from a nearly similar wound, in which the common iliac artery was divided.

I have removed balls on different occasions which have lodged in the bones of the pelvis, and always with the greatest advantage, when done early. I have seen much evil result from their being allowed to remain, causing not only frequent distress, but at last giving rise to disease in the bone, derangement of the general health, and death. When the ball can be felt impacted in the bone, incisions through muscular parts of little consequence, should not be spared, to expose it. If an error exists at this moment, it is that too little is done, rather than too much. Too great reliance is placed on the efforts of nature, and not enough on the resources of art. The constant meddling with a wound is not recommended; nevertheless, much may be done by careful investigation from time to time, of which La Motte gives a good example in his fifty-first observation.

Case 94.—A grenadier was wounded at the battle of Dettingen, in 1743, by a musket-ball, which entered above Poupart's ligament, near the opening of the external oblique muscle on the left side, and lodged. Thirteen days after his reception into the hospital at Landau, Lamotte felt with the probe what he thought was the ball lying on the outside of the psoas muscle against the bone. He made the patient lie on his face, and touched the foreign body every day, in order to loosen it. On the thirty-fifth day he was satisfied it was the ball, and on the forty-fifth, after many attempts, it was at last extracted.—His fifty-second observation relates [illegible] nearly similar as possible to those [illegible]ham and Colonel Wade. He made several deep and long incisions in search of the ball, which he could not find; the wound became fistulous, and at the end of a year closed, in all probability to re-open from time to time.

The difference in practice between 1743 and 1847 ought to be, that in 1847 the ball should be found first, and the deep and long incisions made afterwards for its extraction, which does not of course exclude any previous external openings that may be necessary to facilitate the first examination.

Case 95.—An officer of Engineers, was struck by a cannon shot, on the last days of the siege of Ciudad Rodrigo, on the left hip, which fractured the ilium, carried away a portion of it, and of all the muscles attached to its upper, outer, and back part, from the anterior superior spine to the lumbar vertebræ, which were exposed, and the spinous processes fractured. The peritoneum was separated from the inside of the wall of the pelvis, without being opened into, and momentary hopes were entertained of the possibility of recovery. He never however rallied after the blow, with all the care I could give him, but always suffered great pain, and died on the third day. In other very severe cases of a somewhat similar nature, inflammation was not induced in the cavity of the belly, and I have known persons recover, beyond even the most sanguine expectations.

Case 96.—John Breach, 41st Regiment, aged twenty-two, was wounded across the loins, on the 10th Sept. 1813, on Lake Erie, N.A., by a large shot, which struck him in a slanting direction, from above downwards, commencing at the upper part of the left loin, and proceeding towards the right hip. In its course it carried away the greater portion of the lumbar muscles of the left side, broke three of the spinous processes of the vertebræ, divided the lumbar muscles of the right side, shattered the upper part of the body of the ilium, and tore up, and turned back, the gluteus maximus and medius muscles, leaving the minimus nearly bare.

The exposed surface of this wound, immediately after the accident, measured fifteen inches long, by eight wide. The posterior spine of the ilium was broken in pieces, the fragments of which were driven in among the muscles, and several splinters extended into the body of the bone, some of which were loose, and others fixed.

Nothing could be done at night, but early in the morning, Assistant Surgeon Kennedy removed all the loose pieces of bone which were driven among the muscles, and brought up all the edges of the wound into as small a circle as possible, with straps of sticking-plaster, on the fractured portion of the bone, which remained uncovered, and laid a double fold of linen covered with tow, over the exposed part.

The inflammatory action was considerable for the first three days, with a corresponding degree of fever; an enema was given, with a dose of salts. On the third morning, in dressing the wound, it was reduced to ten inches by six; everything seemed to be going on well for a fortnight, when he was attacked, all at once, with shiverings, night-sweats, and all the concomitants of internal suppuration. This poor fellow, being obliged to lie on his belly, or on his hands and knees, and the suppuration having become profuse, his position favoured the insinuation of matter through the crevices of the fissures, and formed sinuses around the pelvis. It being impossible to change his position, the collections of matter increased, and caused great derangement of constitution. For ten days he was in the greatest agony, and particularly during nights sent forth the most pitiable groans, from sheer excess of pain. An opiate at night was his great consolation, a little biscuit, soaked in Indian-corn coffee, was his only food, common imperial his drink, and his bed, his share of an old sail on the berth-deck; notwithstanding which hard fare, this poor fellow, when at all free from pain, was in good spirits, and always hoped he should recover. The tenth day after this attack, the symptoms diminished in intensity. On the twelfth he complained of pain at the bottom of his belly, on the right side. On examining the part, a little elevation was found above Poupart's ligament, just on the outside of the abdominal ring, on pressing which suddenly, a jerk of matter proceeded from a crevice in one of the fissures of the fractured portions of the ilium, shewing at once its cause and the course of the abscess. This tumour was opened with an abscess lancet, and nearly two pints of pus were evacuated, which gave instantaneous relief; the opening was kept patent by a plug of lint. The broken pieces of bone, now getting loose, were in turns detached, and several pieces were removed; but there was a large piece which extended into the body of the bone, the removal of which would be more difficult, and the cause of greater danger, from the extent to which, on its being detached, the pelvis would be exposed. As the wound was still going on well, and as the pump below, (as the patient termed the opening in front,) was still kept going, this piece was not forcibly detached; nevertheless its removal was aided by gentle efforts, and by encouraging the granulations gradually to raise it from its place.

Notwithstanding the great discharge, he improved rapidly, and on his being moved to a very comfortable hospital establishment, at Presq' Isle, an opportunity was afforded of assisting nature, to renovate his system, and accomplish his cure. It was nearly four months before the remaining large piece of bone could be removed, and it then left a thimble-like cavity into the pelvis; this, however, was soon filled up by healthy granulations. The formation of new skin was, nevertheless a very dilatory process; during the last three months only a few inches having been gained; the wound, when he left the hospital at Presq'Isle to be sent home, measuring six or seven inches by three or four. The granulations, however, had covered the whole surface, except two black spots where the broken vertebræ projected, and were exfoliating. Previously to his leaving the hospital, he could move about with the assistance of crutches, and could turn himself on either side in bed, which he had not been able to do before. On his arrival in England, two years after the receipt of the injury, this wound had not quite healed, and he was admitted into the general hospital, Isle of Wight, where he remained until it was completely skinned over. On his arrival in London, in January, he walked from the Strand barracks to the Tower, to call on his faithful attendant, Assistant Surgeon Kennedy. The wound was then quite healed; the cicatrix however was deep, and as large as the hand of a good-sized man, at which time I first saw him.

CASE 97.—Captain Campbell was wounded, by a pistol-ball, on the 5th of September, 1805, which penetrated the abdomen on the middle of the right side, and was extracted from nearly the same situation on the left, and which from its irregular denticulated shape, would appear to have impinged against a vertebra. He complained of violent pain in the loins and belly, with numbness and pain of the left leg and thigh, and suffered also from the greatest oppression, anxiety, and sickness. An enema was administered, a mild laxative mixture was desired to be given occasionally, as the stomach would retain it, and twenty-four ounces of blood were taken from the arm. At nine at night, a quantity of hardened feces was passed; pain excruciating, and some difficulty of breathing; lower extremities nearly paralysed; anxiety and oppression great. Venæsectio ad ℥x. Cannot pass his water; hot fomentations; enema and medicine repeated, and at 12 at night sixteen ounces of blood were drawn. At 3 P.M. had three motions, the two last containing apparently a pint of pure blood. Pain and other symptoms being as urgent, eight ounces more blood were taken away. At 6, P.M. made water for the first time highly tinged with blood; has had two motions, also mixed with blood. Pain continuing, ten ounces of blood were abstracted although occasionally almost fainting on any movement; belly fomented. At 8 at night, sixty drops of laudanum. At 10, being very restless, twenty drops more, which procured some sleep although he vomited frequently; belly relieved by the fomentation; three stools mixed with blood.

September 6th. All the symptoms relieved; passes blood with his urine; sickness and vomiting troublesome; pulse 90, rather firm than feeble. 1 o'clock; complains of violent pain in left leg and thigh, belly, and loins, pulse 116, full and strong. Venæsectio ad ℥xvj. Barley water with nitre for common drink. 6 P.M. Pulse 96; bowels open, with blood; symptoms generally relieved. Tinct. Opii. gtt. xii at night.

Sept. 8th. Slept better; less pain; paralysis continues. In the evening symptoms aggravated; lost twelve ounces of blood; enema, &c., repeated; pulse 120.

9, 10, 11, 12. Pulse 96; bowels open; urine bloody; is generally better.

15. Wound of exit healed; urine bloody; bowels open. Chicken broth for the first time.

20. The opening of entrance being nearly closed was enlarged, and a free exit allowed for the matter.

October 20. Wounds quite closed; is free from pain, is able to move about the house on crutches; warm stimulating applications to the limbs seem to have given most relief.

November 20. Paralytic affection gone; he can now mount his horse, and has only a feeling of numbness and torpor in the left leg and thigh.

He lost in four days ninety-six ounces of blood.

JACOB J. ADOLPHUS, *Surgeon*, 60*th Regt.*

The general opinion which formerly prevailed, that *wounds of the bladder* by musket-balls, were for the most part mortal, is now known to be erroneous. When the bladder is wounded below, or where it is not covered by the peritoneum, persons often recover by what may be considered the almost unaided efforts of nature. Dr. Thomson, in his report of the wounded in the hospitals of Brussels, after Waterloo, says he saw fourteen cases recovering in which the bladder had been penetrated by musket-balls. A larger number came under my observation there, and at Antwerp, and many had already died. I have never seen a single person recover in whom the urine had found its way into the general cavity of the abdomen. They generally die of inflammation, in from three to six days; and much depends on the nature of the treatment in most of the instances which are curable.

Dupuytren shewed by direct experiments, that injecting bile, urine, or other fluids into the cavity of the peritoueum from the tunica vaginalis, which in animals always communicates with it, gave rise to severe inflammation, although the fluid injected might even be absorbed, so as to leave no trace behind. Some late cases of rupture of the bladder from blows, have led to the supposition that the effused urine, if small in quantity, may be confined in a pouch or *foyer*, as blood is said to be in some few cases, after a wound, and that in this way life may be saved. If such a thing should occur, it will only be one more added to the number of miraculous cases which occasionally take place, contrary to all ordinary experience.*

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* The late Mr. Cline amused himself, at the middle period of life, by farming in Essex, and the breeding of horses. Disgusted by the unsurgical mode adopted, of castrating the colts by the clamp, he had them cut secundum artem, and they all died from inflammation of the belly. The late Mr. Coleman made him acquainted

When the bladder is wounded where it is covered by the peritoneum, and the opening, or openings, do not by some accident, permit the urine to flow into the cavity of the abdomen, the patient may be free from immediate danger for a short time, although very anxious and alarmed greatly depressed in countenance and manner, and even sick to vomiting. The pain is not commonly severe at first, and if he can make water, which in all such cases it is desirable to prevent, it is more or less coloured or mixed with blood. If the urine should not escape into the cavity of the abdomen, the ordinary inflammation which must necessarily ensue, takes place, and affects the internal surface of the bladder. The desire to pass urine becomes greater, and is frequently insupportable, whilst it can in some cases be only passed by drops. In others these symptoms are less urgent. Nevertheless, the natural action of the bladder, or, in those severe cases, the additional efforts which are made for its expulsion by the abdominal muscles, cause the urine to be forced through the wound, and thus to be effused. This takes place more or less in every instance, and when it is forced in this way into the cavity of the abdomen, it proves fatal; whence the advantage to be obtained from the early use of the elastic catheter. When the orifices of entrance and of exit are free, and low down in the pelvis, the urine may run out without much immediate mischief ensuing. But as this cannot always be known, an elastic gum catheter should from the first be introduced, and fixed by the usual means in the bladder, in every case in which the nature of the injury is doubtful, until the urine ceases to flow through the wounds. It must, however, be recollected, that in some cases in which it has caused great irritation, by being introduced too early, and whilst the bladder was very sensitive the patients have been much relieved by its removal. The principle is nevertheless incontrovertible in all doubtful cases; and the urine should be allowed to drop out of the catheter nearly as fast as it passes into the bladder, when this organ is very irritable; great pains should also be taken that the end of the instrument should be within, but not too far within the bladder, so as to excite irritation by rubbing against its sides, or to allow of its end rising above the urine which might in this way collect below it, and at last escape through the wounds.

The next point requiring attention is to restrain the inflammatory actions which ought necessarily to follow, within their proper limits. This is to be done by general bleeding, the application of leeches, the administration of diluent drinks in moderate quantity, the exhibition of gentle aperients, such as the oleum ricini, and by enemata. Opium in all these cases is an important remedy, principally in the shape of morphia; and I prefer the muriate or the bimeconate, when given by the mouth. Opium in substance, when introduced into the rectum in the shape of a suppository, or dissolved in half an ounce, or an ounce of water, as an enema, should be given and repeated per anum, in such quantities beginning with two grains, as will procure ease.

The urine in most cases of injury below the peritoneum, flows readily through the wound of entrance, if not of exit, in the first instance, and care should be taken, by enlarging the posterior one, that no obstacle within reach shall prevent it; but after inflammation has been established, the parts swell, and as the slough begins to separate, its passage is often obstructed; when the catheter, if not used before, will render important service, by allowing the sloughs to be discharged, without the healthy parts being irritated by the urine being retained. After a time, the urine may be drawn off in small quantities through the catheter, as frequently as circumstances may render advisable. The permanent use of the catheter in these cases will often prevent the urine from forming any devious paths as it proceeds outwards, ending in abscesses and fistulous openings, causing much discomfort, and even misery. It is not common for blood to be poured into the bladder in such quantity as to cause much inconvenience; if it should be otherwise, and it coagulates, a silver catheter should be used, by which it may be separated into parts, and rendered more easy of solution by injections of warm water. When the neck of the bladder, or the prostatic part of the urethra is divided, so that a catheter cannot be efficiently used, surgery must come with more immediate aid to the assistance of the sufferer, by making a clear and free opening from the perineum, for the evacuation of the urine, and of the discharge from the wound. If a ball lodges in, or near the bladder, or in the prostate, it must be removed by the operation as for stone.

Barron Larrey in the second volume of his Memoirs and Campaigns, page 165, says "that little urine escapes by the wounds during the first twenty-four hours when the bladder is wounded, in consequence of the tumefaction which takes place in the lips of the wound. When the bladder is full, it flows out at the instant it is wounded, and only by the opening of the exit of the ball. Infiltration is prevented by the thick slough, which fills the track of the wound, and it is only when these sloughs separate that infiltration takes place. It is then of the greatest importance that an elastic gum catheter, as large as the canal of the urethra, should be fixed in the bladder when the slough begins to separate, in order that the urine may be freely evacuated, instead of being detained in the track of the wound." The orifice of entrance has as often allowed the urine to escape, in the cases I have seen, as that of exit; and the directions that follow, in the fourth volume, are not

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with the fact, that the passage of communication of the tunica vaginalis with the cavity of the peritoneum, did not become obliterated in animals, as in man.

quite consistent with the theory which precedes them in the second; they are in page 165. After having enlarged the external wound, a gum elastic catheter is to be fixed in the bladder; it should be changed every two or three days, &c. &c. And he adds, that General Bon died because he would not allow a catheter to be passed, nor his wounds to be dilated. In his Memoir on Wounds of the Bladder, in the fourth volume, he defers the introduction of the catheter until the sloughs are about to separate. " During the first three or four days, which is the period of inflammation, no examinations, nor soundings of the bladder, should take place. It is at the moment when the sloughs separate that the catheter should be fixed in the bladder;" nevertheless, in one of three cases he relates, and one in which the bladder was not opened, but only injured, he fixed a catheter in the bladder from the first. I am of opinion that it is safer to fix it in the bladder in every case the least doubtful from the first, if it can be retained with ease; and that it should not be removed unless to be cleaned, or when distressing to the patient, until it can be entirely dispensed with.

Case 98.—A soldier of the light division, wounded on the heights of Vera, in the Pyrenees, was sent to me at Santander, with eight hundred other wounded, in September, 1813. A musket-ball had entered behind near the sacrum, and had lodged. He was bled twice, in consequence of suffering pain in the part, but was not otherwise much disturbed. There was at first a difficulty in making water, but this gradually subsided; although he always suffered pain in micturition, which was frequent and distressing. He remained in this state until December, when he passed with considerable effort, and after much difficulty, a hard piece of his jacket about half an inch in length, and larger than the orifice of the urethra through which it was forced. As it was not encased by calcareous matter, it could not have been long in the bladder, but must have been lodged near it before it ulcerated its way in, giving rise to the constant desire and irritation which he had so long experienced. His symptoms then subsided, although they had not entirely disappeared, when he left me for England.

Case 99.—A French soldier was wounded by a musket-ball, on the back part of the right hip, at Almaraz, on the Tagus, taken prisoner, and sent to Lisbon, when I saw him in the autumn of 1813. The ball had lodged somewhere, but gave him little inconvenience at the time, beyond some pain in the course of the sciatic nerve, subsequently followed by defect of motion on the right side. Four months after the injury, pain came on about the region of the bladder, with great desire to make water; which he could not do when standing, but which dribbled away when lying down. When quiet he suffered little, but great pain followed any attempt at continued motion. A catheter could be introduced, but with great difficulty when it reached the prostate gland, which was exceedingly tender to the touch. After a time, the catheter could not be passed, and the man was in great agony, until something appeared to give way, and a discharge of matter took place, when the urine followed, and he was relieved. An abscess had formed in all probability, from the proximity of the ball, which still could not be felt. The man recovered, retaining, however, his former state of lameness and defect of power, although relieved from the vexatious irritation of his bladder.

Case 100.—A soldier, of the 4th division of infantry, was wounded at the battle of Toulouse, whilst entering a redoubt, by a musket-ball, which entered at the left groin, and crossing the pelvis, came out on the upper part of the opposite hip behind. The urine flowed from both wounds, and from the rectum, indicating that the ball had passed between these parts, and a little feces came from the posterior wound for three weeks. The pain and suffering were not great, and principally arose from retention of urine, requiring the use of the catheter, which was left in, and changed from time to time, until the urine flowed by the side of it, instead of through the wounds, which it did occasionally for some weeks in drops, but not in any quantity; after which the wounds gradually closed, and the man was sent to England cured.

Case 101.—Jean Sordis, a French prisoner, was wounded, at the battle of Waterloo, by a ball which entered about an inch and a half from the root of the penis, and immediately above Poupart's ligament on the right side, passed through the bladder, and made its exit near the tuberosity of the ischium of the left side. He was sent to Antwerp, and was placed under the care of the civil surgeons, who were in charge of the French hospitals at the Corderie, until the 14th of August, when the wounded were given over to the British. Very little had been done for him surgically, and when he came under my care, the original wound was still open, as well as a fistulous opening, which had formed and gave exit to the urine in the left groin; his health had suffered considerably. An elastic gum catheter was introduced into the bladder the following day, and retained, being removed occasionally; the neighbouring parts, scrotum, &c. were defended from the acrimony of the urine, which had previously caused considerable excoriation, and a light diet was ordered him.

August 28.—At present the fistulous opening is healed, the original wound is doing well, and the quantity of urine that escapes through it is inconsiderable; his health has much improved, and I am of opinion, if no unforeseen accident occurs, this man will do well.

Samuel B. Bruce, *Surgeon to the Forces.*

Antwerp, August 28th, 1815.

Case 102.—James Thompson, 1st. battalion, 5th regiment, on the 10th November, 1813, whilst on a skirmishing party, in the south of France, received a gun-shot wound in the lower part of the abdomen. The ball entered about half an inch above Poupart's ligament, on the right side, and about midway between the symphysis of the pubes, and the anterior superior spinous process of the ilium: it took a direction across the pelvis, and made its exit a little above the tuberosity of the ischium on the left side. He also received a bayonet wound about a quarter of an inch lower than the entrance of the ball; says, that immediately after the infliction of the wounds, feces, urine, and flatus, were discharged from them, and continued to be voided solely by that way for six weeks; after which time to the present, they have passed partly from the wounds, and partly by the natural course; says, that during the last two months, the quantity voided from the wounds is much decreased; wound made by the exit of the ball healed about two months after its infliction; no urine or feces were ever passed by this aperture. The anterior wounds are much contracted in size at present, but discharge a quantity of purulent matter, and, occasionally feces; general health good; says, that during the whole period of his illness, no bad symptom has occurred, nor has any particular surgical treatment been found necessary. The urine is now, one year after the accident, discharged naturally; the bowels are confined, requiring frequently mild aperient medicines.

C. Boutflower, *Surgeon to the Forces.*

Case 103.—A soldier of the Cavalry of the King's German Legion, was struck, at the battle of Salamanca, by a musket ball, which entered just above the pubes, a little to the right side, and came out below on the opposite nates. The urine flowed readily through both wounds for the first three days, when I saw him for the first time, suffering from great pain and distress about the region of the bladder, from which he could not expel any water, neither would it pass by either wound. I immediately introduced a catheter, drew off a moderate quantity of urine, and then fixed it in the bladder, desiring him to let water every hour when awake. This he did, leaving the stopper often out at night. The urine flowed after a few days through the posterior wound, and then ceased. The catheter being washed from time to time, was at last withdrawn as the urine began to flow by the side of it, and the wound had finally closed when he left San Domingo Hospital.

Case 104.—Captain M. received a wound from a musket ball, at the siege of Cuidad Rodrigo, which entered just above the pubes, passed through the bladder and rectum, and came out behind, splintering the sacrum, the contents of both viscera being freely discharged through this opening. As he suffered but little inconvenience from his urine, very little of which passed by the urethra, this passage was not, in the first instance, interfered with. Inflammatory symptoms were kept in due bounds, the rectum was carefully washed out by emollient enemata, and his food rendered as light as possible. Under this treatment he gradually improved; the anterior wound first healed, and subsequently the posterior one, leaving him comparatively well, when he left me for Lisbon on his way to England.

These cases give, however, a brighter view of the nature of these wounds than they frequently justify; extravasation of urine, inflammation, and death, are not of infrequent occurrence; and if this should not occur in the early stages, great misery is often caused, from the irritation of the bladder and the discharge which follows, until the constitution is undermined, and death ensues.

Case 105.—Dr. Waltz, in Graefe and Walther's Journal, refers to a wound from a pistol-ball, which passed through the os pubis and bladder, and made its exit behind, about an inch and a half from the anus. Great depression and alarm followed the injury, A catheter was early introduced, and left in the bladder; the tenesmus was considerable, and was relieved by enemata, and opiates; pieces of bone passed by the urethra, and behind. The patient gradually recovered, the wounds which had cicatrized, re-opening several times until he was ultimately cured, eight months after the receipt of the injury.

Case 106.—A French officer was struck at the battle of Salamanca, by a musket-ball, which passed through the sacrum, and made its exit just above the pubes. Urine passed through both wounds, and a small quantity of feces through the opening behind. He died at the hospital under my care, on the field of battle, on the third day, from severe peritoneal inflammation, in spite of the most vigorous treatment.

Case 107.—Daniel Cliff of the 45th Regiment, was wounded, on the 6th of April, at the battle of Toulouse, by a musket-ball, which entered the lower part of the right side of the belly above Poupart's ligament, passed obliquely across the pelvis, and made its exit at the left nates. Blood and urine came through the anterior wound. The belly swelled, with pain at the lower part, which was increased by a desire to make water, although, none could be made. He was largely bled the next day, and a catheter was passed from time to time. On the 8th, urine passed freely by the anterior wound, but none by the posterior, or by the urethra; belly tense and painful; bled again largely, which was repeated on the 10th, when he was taken into hospital; the catheter was then left in the bladder, and the inflammatory symptoms steadily treated; but in vain, as he died on the 14th, eight days after the receipt of the injury.

Case 108.—Capt. Sleigh, of the 100th regiment, was wounded at the battle of Chippewa, on the 5th of July, 1814, by a musket-ball, which entered the left groin, immediately over Poupart's ligament, by the side of the spermatic vessels, injuring in its course the anterior brim of the pelvis. It thence passed through the bladder obliquely across the pelvis, and terminated its course beneath the integuments in the right buttock, whence it was immediately extracted. Blood and urine flowed incessantly from his groin, and the quantity of the former he lost was considerable. He complained much of pain in the hypogastric region; the abdomen was tense and painful to the touch, and he had an almost continued inclination to micturate; but his attempts, after the most painful efforts, were entirely frustrated. The anxiety was great, the respiration hurried, and the pulse quick and fluttering. He was bled to the extent of thirty ounces; an enema was given; fomentations applied to the belly; and the catheter introduced; all which afforded him some relief. The next day he was removed to the rear, a distance of seventeen miles, in an open waggon, partly during the inclemency of the night, and was quite worn out by so long a journey. He was carried thence on board ship, and landed at York, on the morning of the 9th of July, the fourth day after he received his wound.

July 9, vespere.—Pulse quick; respiration hurried; anxiety great; restlessness; features pale and shrunk; abdomen tense and painful to the touch; severe pain in the perinæum; great inclination to void his urine, and attempts fruitless; wound in the groin sloughy, discharges urine and blood, mixed with a small quantity of pus; posterior wound healthy, no discharge of urine from it; bowels confined; catheter attempted to be passed without success. ℞. Olei Ricini, ℥iss. statim.

Warm fomentations to be frequently applied to the belly.

10.—Passed a restless night; had two copious stools; voided a few drops of urine by the urethra; has still great inclination to make water; abdomen tense and painful; wound of groin sloughy; discharge very fœtid.

℞. Ext. Opii. gr. ij.; fiat pilula.

Vespere.—Symptoms since morning all aggravated; has considerable thirst; pulse quick; and skin hot.

℞. Subm. Hydrarg. gr. iv.
Pulveris Jacobi gr. iij. fiat pilula.

11.—Passed a good night; all his painful sensations much relieved; pulse slower; skin moist; anxiety abated; abdomen less tense; wound of groin still sloughy, and discharge fœtid; a small piece of bone extracted from the urethra about an inch in length, and of the thickness of a crow-quill; a little urine followed more freely.

Pilula opii horâ somni sumenda.

15.—Complains of severe pain in the spermatic cord; discharge from groin more offensive; wound filled with large maggots; bowels open.

19.—Wound of groin looks clean; a small piece of bone discharged by the urethra, and a piece of cloth extracted from the groin.

22.—Discharge of urine by the urethra becoming more copious; wound of groin contracting.

24.—A small piece of bone extracted from the groin.

29.—Posterior wound almost closed; discharge from groin less fœtid.

August 5.—Passes a good deal of pus and urine by the urethra.

13.—Was attacked with ague yesterday; paroxysms slight.

15.—Ague returned yesterday, ter in die; paroxysms milder. Decoctum et pulv. cinchonæ.

17.—Has had no return of ague. Repet: cinchona.

29.—Posterior wound much inflamed, and very painful upon pressure. A poultice to be frequently applied.

30.—Inflammation more extended; pain more severe; great hardness upon pressure.

Sept. 1.—Abscess has burst; a piece of cloth has been extracted; urine and pus are discharged by both wounds.

2.—Discharge of urine and matter very copious.

6.—Had an attack of ague yesterday; paroxysms severe.

℞. Solutionis arsenicalis m. v.
Tincturæ opii m. x.
Misturæ camphoræ ℥iss.
M. ft. haust. ter in die sumend.

9.—Had an attack of fever yesterday; paroxysms severe.—Pergat.

12.—Doing well; wounds closing. Medicine omitted.

16.—Bladder resuming its power; discharge of matter from groin very trivial.

Oct. 4.—Wound of groin nearly closed.

18.—Posterior wound closed.

30.—Wound of groin closed; urine passed by the natural passage, mixed with pus.

Nov. 12.—Has had a return of ague; embarked on board ship for Kingston, a change of air being recommended.

The copious bleeding on the evening he received the injury, was the means of preventing the impending inflammation, so much dreaded. It was very surprising to see a longitudinal piece of bone finding its way into, and along, a passage so narrow as the urethra.

At first, I supposed that only the fundus of the bladder was wounded; but when the collection of matter took place in the right buttock, and a piece of cloth was extracted, the urine following, I was satisfied that both sides of the bladder had been transfixed by the ball; and that, probably, the urine from the commencement had been prevented from flowing posteriorly, by the intervention of this foreign body. An elastic gum catheter could not be passed into the bladder on account of the piece of bone which had forced its way into the urethra, and from its being obstructed afterwards by smaller pieces of bone. Captain Sleigh had several attacks of ague after he recovered; during one of which, ten months afterwards, the groin became painful and inflamed; and the parts giving way, the urine was again discharged by the wound. About six weeks afterwards, it again closed, and has remained so ever since, but his urine is always mixed with a considerable quantity of pus. The left leg is weak and limited in its motion, and he complains of much debility about the small of the back, and will not, in all probability, be able to undergo the hardships and fatigues of a military life.—*L. Douglas, 8th Regiment.*

When I saw this gentleman some time afterwards, it appeared to me that the purulent discharge from the urethra was not from the inner membrane of the bladder, but was caused by the dead bone of the pelvis having a communication with the bladder by a fistulous opening.—G.

Case 109.—A. Labiche, 7th French Dragoons, was wounded by a musket ball, at Waterloo, which entered the left hypochondrium, near the anterior extremity of the twelfth rib, and made its exit near the spinous process of the second lumbar vertebra. Passed some blood with his urine at first, and by the posterior wound some feces and pus. On the 14th of July, he passed air through the urethra, judging from the gurgling noise it made. On the 20th, urine passed by the posterior wound, and air by the penis, as shown by immersing it in water, both of which ceased the beginning of August. After a few days they returned with a greater discharge from the wounds, which became fistulous, and in this state he was sent to France.—*Theodore Gordon, M.D., Staff-Surgeon.*

Case 110.—A soldier, of the King's German Legion, was struck, at Waterloo, by a musket-ball, which entered a little way above the pubes, and lodged. The symptoms which immediately followed were by no means severe, although he had passed a little bloody urine at first; and the external wound closed without difficulty. He complained of pain at the neck of the bladder, and a great desire to make water, with other signs of stone in the bladder, which induced me to pass a sound, when I found that the ball was lying loose in the bladder. Staff-Surgeon Campbell, under whose care he was, at once acceded to my request to send him to the York Hospital, at Chelsea, being another instance, I am glad to mention, of the attention and kindness with which I was treated, on all occasions, at Brussels by the medical officers of that army. On his arrival at the York Hospital, he became, with the French soldier whose thigh I had amputated at the hip-joint, an object of great attention. I performed the operation for the removal of the ball in the presence of a large concourse of military and medical persons. It was done in less than two minutes; but the calculus, composed of the triple phosphates which had been formed around it, as Dr. Marcet afterwards ascertained, yielded, and broke under the forceps. The pieces were removed separately. The ball being heavy fell below the neck of the bladder, which, being healthy, yielded to the pressure, and allowed it to sink on the rectum; and I could not bring the end of the forceps low enough to grasp it. In this dilemma, I introduced a finger into the rectum, raised it up, and caught it at once, to the great satisfaction of all present. The bladder was then well washed out, so as to remove all the pieces that might remain, and the man was removed to bed. He was bled once, in consequence of some apprehension of pain; but he had not a bad symptom, and rapidly recovered.

The symptoms of irritation did not entirely pass away, as I could have wished, and I began to fear that some small piece of calculus had been overlooked; when one morning, after considerable efforts, he passed a ring of calcareous matter, which had formed around the orifice of the bladder, and which being dislodged, had fortunately entered the urethra, along which it was forced by the urine. It was evidently formed of the phosphates in sand, which had become agglutinated together, around the meatus of the bladder. This he took with him to Hanover, where it and he, and his double wound, attracted great notice. The ball, which was flattened on one side, I kept in a small box, together with the pieces of calculus which were extracted, and shewed them annually at my lecture on this subject for many years. One evening, however, I unfortunately left my little box on the table after lecture; and when I recollected, and returned for it, I found that some gentleman had borrowed it.

Balls have been stated to have been lodged in the bladder by several of the older authors, as Bartholin, Seger, Hildanus, Duverger, Binninger, Covillard, Burgowen, Garengeot, Petit, and Morand, and by Percy, Cline, Crampton, and others, among the moderns.

Baron Larrey laid before the Royal Academy of Medicine of Paris the history of two cases somewhat similar. In the first case, the ball entered the pelvis through the sacrum, traversed the rectum, and dropped into the bladder, blood and urine passing by the rectum. As the man recovered, he thought he felt something roll in the bladder. At the end of a month the external wound was closed, and in two weeks afterwards the urine ceased to flow through the rectum. Ten years afterwards, still suffering from derangement of the function of the bladder, a hard substance was found on examination with the finger, in the situation of the prostate, but to one side. This was considered to be the ball, and the cause of all his distress. Langenbeck removed it by the lateral operation for the stone, and the man, after some suffering and difficulties, perfectly recovered.

In the second case, M. Guernon, Lieutenant of the 92nd of the line, was wounded by a musket-ball, in the inner and upper part of the right groin, through which wound purulent matter and urine passed. He suffered much from pain in the region of the bladder, and from a constant desire to make water, which came in small jets, mixed with blood. An examination of the bladder with the sound gave an obscure sensation of a foreign body in that organ. The operation for the removal of a stone having been performed by the Baron, he extracted a small ball, without difficulty, on the fifth day after the injury. On the seventh after the operation, the urine passed by the urethra; and on the twenty-first, he left the hospital cured, to join his regiment.

Mr. South has recorded in his translation of Chelius a case somewhat similar to those related, in which a piece of the man's clothing, rolled up, of the size of a goose quill, and about two inches long, came through the urethra, at the end of a few days after the receipt of the injury, in July, 1811. In February, 1812, Mr. Cline performed the operation for stone, and removed a ball which was found to be encysted on the left side of the bladder, much flattened, and having a small portion of bone adhering to it. Similar operations have been done by others. The only case I am acquainted with of a ball having been passed by the urethra is related by Bonnetus; but then it was not larger than a good sized pea.

Pieces of cloth and of bone have been frequently discharged through the urethra, as well as air and collections of matter which have been occasioned by the irritation of some foreign body.

Dr. Hennen relates the case of a light infantry soldier which he brought under my notice at Brussels, the man having been wounded by a musket-ball, which entered close to the pubes and came out through the nates of the same side near the sacrum. The urine passed entirely by the anterior wound, and none by the urethra. He was treated antiphlogistically, and partly, but not regularly by the catheter. An abscess formed in the thigh, perhaps in consequence, from which several small pieces of bone and urine were discharged for several months, and some sand by the urethra. I have seen two cases, one of an officer, nearly similar, who recovered, the particulars of which I have mislaid.

Case 111.—The following from Baron Percy, is in point:—A young man was wounded by a pistol shot, which entered just above the os pubis, through the linea alba, wounded the bladder, and lodged. The belly swelled; a tumour formed in the perineum; no urine passed; the bowels were confined, and fever ran high, with a tendency to delirium. Believing that the tumour in the perineum, and the fluctuation he thought he perceived, might be caused by extravasated urine, he punctured it with a trocar, and evacuated a large quantity of bloody urine. This induced him to enlarge the opening, and carry it on to the bladder, through which he brought out the ball, some shirt, and several clots of blood. The man was bled nine times in all; the urine after a time passed in the ordinary way, and the patient slowly recovered.

The *rectum* may be wounded without any other organ being injured within the pelvis, of which I have seen several instances. An officer of the Navy was struck by a rifle-ball towards the lower part of one side of the sacrum, after being knocked down by one he had received on the head, and by another in the neck and back. The ball which passed into the rectum, made its exit on the opposite side of the sacrum, and stercoraceous matters were evacuated by both. The pain was severe; the limbs were deprived of much of the power of motion, and the next day, the bladder was incapable of expelling its contents. This was relieved by the catheter, and the rectum was kept clear by warm mild enemata, whilst the inflammatory symptoms were subdued by bleeding, opium, starvation, and rest. At the end of three months he was able to walk, but with some difficulty, on account of a defective power in one leg; some small piece of bone came away and the wounds closed, although he was subject to an occasional slight opening of the orifice of entrance, whence a little matter was discharged, when it again closed; he remained more or less lame until his death, which took place with the loss of the ship he commanded in a hurricane, on the coast of North America.

Case 112.—A French soldier was wounded at the battle of Salamanca, by a ball, which entered by the side of the sacrum and lodged. Having been rode over and bruised, he was taken prisoner, and brought to me on the field of the battle, where I remained three days with the worst of the French and British wounded. From this wound he suffered comparatively little, except from a difficulty of making water. On the third day after his arrival at the San Carlos Hospital, or the sixth from the receipt of the injury, he passed the ball per anum. The wound quickly closed, and he aided his comrades as an orderly in the hospital afterwards.

Case 113.—An officer was wounded near Bayonne, by a musket ball, on the left side, which passed through the ilium, across the pubes, making its exit through the gluteus maximus of the opposite side, but lower down. Urine flowed through both wounds at first very readily, but none of any moment came by the urethra, from which some blood occasionally oozed. The attempt to pass a catheter failed, although the desire to make water was urgent and painful. After a few days, the passage of urine by the external wounds became obstructed, apparently by the slough; great pain and misery were experienced; fever ran high; rigors and delirium followed extravasation of urine, and death closed the scene. The mischief here arose from the catheter not having been passed into the bladder, which could not be effected, from the prostatic part of the urethra or the neck of the bladder being injured.

This case required the catheter or staff to be passed down the urethra as far as it would go, when an incision should have been made upon it, as in the lateral operation for the stone, until the finger rested upon the wounded parts, when, in all probability, a straight catheter could have been carried through them into the bladder. The urine would at all events, have had a direct passage outwards, instead of coming out of the bladder by the external openings. I advised the performance of this operation, but it was thought to be too late. I have seen other cases, at different times, under similar circumstances, in which it ought to have been done; and I leave my opinion on this point as a legacy to those who may follow me, for their observation, and I hope their instruction, and the advantage of their patients.

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## GENERAL CONCLUSIONS.

1. Severe blows on the abdomen give rise to the absorption of the muscular structures, and the formation in many instances of ventral hernia; which may in some measure be prevented during the treatment, by quietude, by the local abstraction of blood, and by the early use of retaining bandages.

2. Abscesses in the muscular wall of the abdomen, from whatever cause they arise, should be opened early; for although the peritoneum is essentially strong by its outer surface, it is but a thin membrane, and should be aided surgically as much as possible.

3. Severe blows, attended by general concussion, frequently give rise to rupture of the solid viscera, such as the liver and the spleen, causing death by hemorrhage. When the hollow viscera are ruptured, such as the intestines or the bladder, death ensues from inflammation.

4. Incised wounds of the wall of the abdomen of any extent, rarely unite so perfectly (except perhaps in the linea alba) as not to give rise to ventral protrusions of a greater or less extent.

5. As the muscular parts rarely unite in the first instance after being divided, sutures should never be introduced into these structures.

6. Muscular parts are to be brought into apposition, and so retained principally by position, aided by a continuous suture through the integuments only, together with long strips of adhesive plaster, moderate compression, and sometimes a retaining bandage.

7. Sutures should never be inserted through the whole wall of the abdomen, and their use in muscular parts under any circumstances is forbidden; unless the wound, from its very great extent, cannot be otherwise sufficiently approximated to restrain the protrusion of the contents of the cavity, the occurrence of which case may be doubted.

8. Purgatives should be eschewed in the early part of the treatment of penetrating wounds of the abdomen. Enemata are to be preferred.

9. The omentum, when protruded, is to be returned, by enlarging the wound, through its aponeurotic parts if necessary, but not through the peritoneum, in preference to allowing it to remain protruded, or to be cut off.

10. A punctured intestine requires no immediate treatment. An intestine when incised to an extent exceeding the third part of an inch, should be sewn up by the continuous suture in the manner recommended, pages 26 and 27.

11. The position of the patient should be inclined towards the wounded side, to allow of the omentum or intestine being closely applied to the cut edges of the peritoneum. Absolute rest, without the slightest motion, should be observed. Food and drink should be restricted, when not entirely forbidden.

12. If the belly swells, and the propriety of allowing extravasated or effused matters to be evacuated seems to be manifest, the continuous suture or stitches should be cut across to a certain extent, for the purpose of giving this relief.

13. If the punctured or incised wound is small, and the extravasation or effusion within the cavity seems to be great, the wound should be carefully enlarged, and the offending matter evacuated.

14. A wound should not be closed until it has ceased to bleed, or until the bleeding vessel has been secured, if it be possible to do it. When it is not possible so to do, the wound should be closed, and the result awaited.

15. A gun-shot wound penetrating the cavity can never unite, and must suppurate. If a wounded intestine can be seen or felt, its torn edges may be cut off, and the clean surfaces united by suture. If the wound can neither be seen nor felt, it will be sufficient for the moment to provide for the free discharge of any extravasated or effused matters, which may require removal.

16. A dilatation or enlargement of a wound in the abdomen should never take place, unless in connexion with something within the cavity rendering it necessary.

17. When balls lodge in the bones of the pelvis,

they should be carefully sought for and removed, if it can be done with propriety and safety.

18. In a wound of the bladder, an elastic gum catheter should be kept in it, until the wound is presumed to be healed—unless its presence should prove injurious from excess of irritation, not removed by allowing the urine to pass through it by drops as it is brought into the bladder.

19. In all cases in which a catheter cannot be introduced, in consequence of the back part of the urethra or the neck of the bladder being injured, an opening for the discharge of the urine should be made in the perineum.

20. The treatment of all these injuries must be eminently antiphlogistic, principally depending on general and local blood-letting, absolute rest, the greatest possible abstinence from food, and in some cases from drink, the frequent administration of enemata, and the early exhibition of mercury and opium, in the different ways usually recommended, with reference to the part injured.

# APPENDIX.

Case 114.—Private Samuel Fletcher, 31st regiment, wounded at Sobraon, on 10th February, 1846, died at Chatham, February, 1847. On opening the thorax, the greater part of the stomach, the transverse arch of the colon, and omentum were found in the left pleural cavity: this lung adhered very firmly and closely to the walls of the chest as low as the ninth rib, by adhesions of long standing. The lung was pushed to the upper part of the cavity, but on account of the adhesions to the ribs, it was compressed into a thin layer, which lined the walls of the thorax. The heart was also displaced, and lay behind and a little to the right of the sternum. The large curvature of the stomach, partly covered by omentum, lay in front, and first showed itself on opening the chest. The transverse arch of the colon was to the left of the stomach, and between it and the ribs; the stomach reached a little higher in the chest than the gut. There was an opening in the diaphragm, with rounded margin, 2½ inches in diameter, 2 inches to the left of the œsophagus; the peritoneum lining the diaphragm proceeded through the aperture, and became continuous with the pleura. The serous surface around this opening, although smooth and uninterrupted was somewhat thickened, and had the appearance of old cicatrization. In the pleural sac, close to the opening in the diaphragm on its posterior and external margin, the stomach, colon, and omentum adhered firmly to the pleura covering the diaphragm and ribs, to the extent of a few inches. There were also two broad, thin, and loose bands of adhesions, about eight inches in length, stretching from the omentum to the base of the lung, and side of the pericardium. The stomach and colon were however loose and free in the pleural sac; the parts in the aperture of the diaphragm were free from adhesions, and not at all constricted, and the fingers were easily introduced through it, from the abdomen into the thorax. The œsophagus, after penetrating the diaphragm in the usual place, took a sharp turn to the left side; the stomach then entered the thorax, a portion of the cardiac extremity of which still, however, lay in the abdomen in front, and to the right of the spleen; the larger part having entered the chest, curved round, and descended to the opening in the diaphragm; the pyloric orifice lay immediately in the aperture; about a foot and a half of the transverse arch of the colon, with the omentum attached, were also in that cavity. On the skin, exactly opposite, and corresponding to the opening in the diaphragm, were two old cicatrices, on the left side of the chest; one between the eleventh and twelfth ribs, close to the transverse processes of the vertebræ; and the other, between the eighth and ninth ribs, three and a half inches from their cartilages. The musket-ball, in its course through the thorax, must have wounded the diaphragm, and permitted the hernia of the stomach and colon. The structure of both was healthy. The posterior aspect of the right lung was attached to the chest by adhesions of long standing; the heart was of its natural size, and its structure healthy. On tracing the small intestines, five intus-susceptions were found, the first situated at a foot and a half from the duodenum, and the other four were generally from eight to ten inches apart; the portions intus-suscepted were in each about two inches; there was no vascularity or congestion in the intus-susceptions, or in any of the abdominal viscera. Both portions of the stomach, viz., the part in the chest and that in the abdomen, contained a quantity of dark fluid, mixed with portions of food and medicine. The duodenum, and upper part of the jejunum, as far as the first intus-susception, were distended with flatus. The small intestines below the invagination, although not distended, but in their normal condition, were coated with mucus, tinged with bile. The caput coli and ascending colon, to where it entered the chest, were distended, and contained a quantity of fluid and hardened feces. The transverse arch of the colon was distended with flatus and some feculent matter. The descending colon and rectum were empty. Liver healthy; weight, three pounds, four ounces; spleen healthy; kidneys healthy; weight of right, six ounces, three drachms; left, six ounces, two drachms. The parts forming the hernia are preserved, and placed in the Museum.

D. Williamson, *Staff-Assistant Surgeon.*

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I have printed this case out of its proper place, that I might be able to record even one instance of a penetrating wound of the abdomen, from the four great battles lately fought in India; after which the man lived to return to England. It confirms the fact, first stated in a note, page 13, in my work on the Great Operations of Amputation at the Hip-Joint, &c. &c., that " Wounds of the diaphragm never unite (in consequence of the motion of the part), but always leave an opening, with rounded edges, through which herniæ of the stomach or intestines are apt to be formed, and sometimes become strangulated.

THE END.

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VII. On the OPERATIVE SURGERY of the EYE. A Critical Inquiry into the Operations required for the Cure of Cataract, &c. &c.

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A TREATISE on the WOUNDS and INJURIES of the CHEST will shortly issue from the Press, with a Compendious Edition of the Works out of Print, necessary to complete the record of the Surgery of the Peninsular War, with such Additions and Observations as time, and the improvements in Surgical Science, may have rendered necessary.

ON

# WOUNDS AND INJURIES

OF

# THE CHEST;

BEING THE

## THIRD PART

OF THE

## LECTURES ON SOME OF THE MORE IMPORTANT POINTS IN SURGERY.

BY G. J. GUTHRIE, F.R.S.

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# PREFACE.

The following observations, constituting the last of the records of the Surgery of the War in Portugal, Spain, France, and the Netherlands, are published nearly as they were delivered on all practical points, in those Lectures on the Principles of Surgery, which for thirty years were open to all the officers of the various branches of the Public Service. I can only repeat now to them, and to all others to whom these recommendations may afford assistance, what I was in the habit of saying formerly. "Follow implicitly the precepts I have laid down, until you have reason, from your own observation, or from that of others, to doubt. A little further experience will then enable you to confirm what I have said, or to lay down in turn other principles, which, whilst they supersede mine, may be of more service to mankind." It is almost needless to add, that the principles and the practice thus inculcated, were not those which prevailed anterior to that war.

The precepts I have endeavoured to enforce cannot, however, be carried into execution on any of the great occasions in which they are most wanted. They require a greater attention, a greater degree of labour on the part of the medical men, than the number usually allowed can give. They generally have been totally unequal, from their scarcity, and oftentimes from their age, to the duties required from them. The sick and wounded, when in great numbers, have been neglected; all receive some little attention, few enough on those essential points which are necessary for their safety.

When the army, under the command of Sir Arthur Wellesley, landed in Mondego Bay, in August, 1808, it appears in general orders that the head of the medical department obtained two carts drawn by bullocks for the conveyance of the stores necessary for the army, which he loaded with a certain quantity of bearers, tin cups, spitting pots, and other pots, none of which did or could arrive either at the place, or at the time, that even they could be wanted; and nothing need be more inefficient than the medical department of the army during the first two-thirds of that war. It was only when it had attained the summit of the Pyrenees that its medical department approached perfection. The Duke of Wellington crossed the Adour in the beginning of 1814, and after some hard fighting gained the battle of Orthez on the 27th February, the little fight of Tarbes on the 10th of March, and the last victory of Toulouse on the 10th of April. On all these several occasions, from the Adour to the Garonne, a sufficient number of doctors was forthcoming; and when the army moved forward from Toulouse, the medical department accompanying it, was equal to the charge of the wounded of another battle, if one had taken place. The hospitals at Toulouse were left in the highest order. The French and English surgeons visited each other—every case of interest was thoroughly investigated, and the surgery of the British army, and of the Empire, dates much of its improvement from the facts elicited or confirmed on that occasion. And why was this so? Simply because the necessary means of every kind were at hand; the medical men were numerous, young, and efficient.

Within one year the battle of Waterloo took place. The army was not the Peninsular army, neither were all its doctors. Few, if any, of the medical staff-officers left at Brussels (not placed in charge of wounded officers) had seen a field of battle, and the confusion during the first few days need not be described. Among the assistant-surgeons I found some who had served at Toulouse. They were doing everything they should not have done. An amateur myself, and no longer their immediate chief, I was not entitled to signify my disapprobation. It was not however necessary; for they all, as I looked first at their cases and then at them, expressed the regret they felt, that I should see them doing what they knew I could not approve. They urged, in extenuation, that they were overwhelmed with work, and were half dead, and could not do more. Their apologies were offered without one word from me, and merely from their own sense of right and wrong. The greatest efforts were made to obviate this state of things. Flemish surgeons were hired; amateur surgeons flocked over from London; and some of the ablest and most efficient officers of the staff were brought from all quarters. They rectified these evils as far as they could, but nothing could recall the past, nor the irretrievable mischief the insufficient medical care had occasioned in the first few days. The result was, that the great battle of Waterloo, with its host of wounded and its almost wonderful opportunities, added little to surgical science. I am not aware of one single fact brought out, confirmative of any surgical principle beyond what was known and had been practised in the south of France the year before.

The same result has followed the four great battles lately fought in India: the same loss of life, the same succession of human sufferings, the same loss to science; and solely because the surgeons of the Royal and of the Indian armies were, in a similar manner, overwhelmed by the extent of their labours. It was utterly impossible for them to give due attention to even half the wounded depending on them for the alleviation of their miseries.

It does not signify by whom an army is commanded—the same evils will always follow, if the same system is pursued. It may be the Duke of Marlborough or the Duke of Wellington, a Moore or a Lynedoch, a Beresford or a Hardinge. Their armies have all suffered alike on this point; and their successors will also suffer, if the Civil Authorities of the country will not allow themselves to be guided in matters which they do not practically understand, and a knowledge of which they have not acquired in a manner to render it thoroughly efficient.

When the private and public reports of the medical officers present at the four battles on the Sutlej arrived in England, I addressed a letter to the Honourable the Court of Directors of the East India Company, dated March 11th, 1846, pointing out the faulty nature and the insufficiency of their medical arrangements; and I took the liberty of transmitting a printed copy of this letter to those members of the late and present administration, whose duties led them to be conversant with such affairs. Two years have elapsed, and nothing has as yet been done; but as no one line of that letter can be controverted or disproved, and as I know it has attracted the attention of some of the highest authorities, I feel it will best become me to leave the matter in their hands. Future evils they may prevent; the past they cannot recall.

When the invalids from these four battles arrived at Chatham, I wrote to the medical officers in charge, requesting that they would examine in the most careful manner all those men who had been wounded through the chest, that any information thus obtained might appear in these Lectures. My astonishment was great to find that *seven* such cases only had arrived from India. It induced me to turn to the records of the persons similarly wounded at Toulouse, and I find it stated (see page 72, which gives some other instances) that, after that battle, on the 10th of April, 1814, one hundred and six cases of wounds of the chest, in officers and soldiers, were admitted into the hospitals of the town, on the 12th; and that, between that day and the 28th of June, thirty-five died, fourteen were discharged to duty, and fifty-seven were forwarded to England, few or none, in all probability, to return to the service. The number of wounded received into the hospitals of Toulouse, was 1,359, including one hundred and seventeen officers.

The medical staff present during the first week, consisted of the inspector-general, Sir J. M'Grigor, (to approve or to censure), two deputy-inspectors, eight staff surgeons, two apothecaries, eighteen assistant staff surgeons, and twenty-three regimental assistant surgeons, but not one regimental surgeon, they having all remained with their regiments: this number was augmented, in the second week, by two staff surgeons, seven assistant staff surgeons, one regimental assistant surgeon, and four apothecaries.

The ten staff surgeons are dead; but there is not one of the forty-nine-assistant-surgeons now living, who will not declare that from six in the morning until nine at night, he laboured as hard as he ever had done before or since.

The number of wounded of the Royal army, in the four great battles in India, amounted to three times that at Toulouse; the proportionate number of men shot through the chest and sent to England, would be by computation *one hundred and seventy-one*, instead of *seven*; a difference which can only be accounted for by the fact that the inspector, the two deputy inspectors, the eight staff surgeons, and the eighteen assistant staff surgeons, were none of them to be found with the army on the Sutlej. The regimental medical staff were totally incapable of doing the duty required of them, and the medical department of the Indian army, was even more inefficient in point of numbers. The same Herculean efforts were made by the Governor General and the Commander in Chief, to procure doctors, as after the battle of Waterloo, and with a similar result. They came too late.

I have in my possession a report from a medical officer of the Company's Service on the state of the wounded, three months after the first battle, which it would answer no good purpose to publish. It would be merely what might have been said of the state of the wounded in Portugal and Spain, during the first four years of that war. The *official* statistical returns of the sick and wounded during the Burmese war shew a loss of forty-eight and a half per cent.; those when published of the war in China, will I understand be no better. The cause is well known—the remedy is in great part attainable. The evil remains.

When Charles VI. of France sent to Spain in aid of Pedro the Cruel, the renowned warrior, Bertrand Du Guesclin, at the head of the reiters, the lansquenets, the free compagnons of his army from whose prowess he had derived the greatest advantages; and heard in due time, that their bones were whitening the fields of Castille and Navarre, he drew consolation from the fact, that they could not return, and would not be able to claim the rewards, the pensions he had promised, and to which their services entitled them. I am afraid that after the lapse of three centuries, no better consolation can be afforded to the people of Great Britain, under a similar, but more severe infliction.

The Royal Army of Great Britain is not composed of mercenaries. Its soldiers are the blood, the bone, the sinew of the nation, on whose indomitable valour alone can dependance be placed in the hour of danger. By them the victory must be won, by them the loss must be sustained; and a country grateful for their services, should watch over them in their necessities, as a mother over her children.

I have been asked, why I presume to obtrude my opinions on any one, much more on the great Civil authorities of this country, who do not desire them? The answer is simple. There is no one who ought to understand the subject so well, although there are many perhaps who do understand it better. It has been enquired, what place I am seeking to obtain? The answer is more simple still. I am a man without a wish—without desire—for anything which belongs to this world; I seek a place in which I and all the authorities I have ventured to address shall one day stand before HIM by whose all-seeing eye our inmost thoughts will be laid bare, and when I earnestly pray that my endeavours in behalf of the helpless may be favourably judged.

4, *Berkeley Street, Berkeley Square.*
March, 31, 1848.

## *SURGICAL WORKS by MR. GUTHRIE.*

I. On INFLAMMATION, MORTIFICATION, and on GUN-SHOT WOUNDS; on the INJURIES of NERVES, and of the EXTREMITIES, requiring the OPERATION of AMPUTATION at the HIP-JOINT, SHOULDER-JOINT, &c. Third Edition.

II. LECTURES on the TREATMENT of COMPOUND FRACTURES, and on the EXCISION of the EXTREMITIES of BONES, &c. &c. &c.

III. On WOUNDS and INJURIES of the HEAD affecting the BRAIN.

IV. On WOUNDS and INJURIES of the GREAT ARTERIES of the HUMAN BODY, with the OPERATIONS REQUIRED for their CURE.

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IX. On WOUNDS and INJURIES of the ABDOMEN and PELVIS.

X. On WOUNDS and INJURIES of the CHEST, completing the Record of the Surgery of the Peninsular War, with such Additions and Observations as time, and the improvements in Surgical Science, have rendered necessary. 1848.

# LECTURES

ON SOME OF THE MORE

# IMPORTANT POINTS IN SURGERY.

## PART III.

## ON WOUNDS AND INJURIES OF THE CHEST.

### LECTURE THE FIRST.

*Impolicy of the separation of surgery and physic ; Danger oj wounds of the chest; Advantoges of auscultation; bayonet wounds rare; Complication of non-penetrating wounds by pleuritis or pneumonia; nine Cases; Dr. Stokes' case of pneumonia and gangrene of the lung from external injury; Healthy sounds heard, during respiration, through the stethoscope; Experiments of Van Swieten, Dr. D. Williams and Mr. Quekett on wounds of the chest; Percussion.*

A knowledge of the practice of physic is inseparable from the practice of surgery, generally; it is especially so in the treatment of injuries of the chest, if the patient is to receive that assistance which the art and science of medicine, in its most comprehensive sense, can grant. In my introductory lecture, for October, 1824, which was honestly taken, and published in the 5th volume of the *Lancet*, I said, nearly in the following words: " *Surgery* is considered by some persons to be the management of that art and science by which we take upon ourselves the treatment of external diseases, in opposition to *physic*, which takes cognizance of internal complaints. This, however, is an artificial distinction; one unknown in nature, foreign to her principles, and incapable of being preserved, by those who have extensive opportunities of practising the profession. In a large town, the surgeon, the physician, the apothecary, and the professor of midwifery, practising separately, may be brought together; and it may be said that a union of scientific men, each devoted to different parts of the same pursuit, is desirable in cases of doubt and obscurity. If the argument could be supported for a moment for the perfect separation of these branches of one and the same science, there is nothing to prevent a still further separation of the treatment of disease, even to infinity. The practice of surgery ought never to be separated from the practice of physic, if the surgeon is to take the (sole) charge of accidents. In the cure of a simple fracture of the leg, is nothing further necessary than the mere mechanical coaptation of the parts ? Is the bone like a piece of timber, unconnected with a living structure ? If it be so, a carpenter could replace it as well as a surgeon. It is, however, a part of the living body; it re-acts on the system, and requires constitutional, as well as local, treatment; the *Physician* will be necessary, therefore, at every visit, to afford the requisite relief. If the *Surgeon* is to be any other than the mere drudge, or artist, he must first learn the principles, and he must then continually *engage in the practice*, of physic."

These opinions were expressed nearly twenty-four years ago; they preceded all those of the different gentlemen who have thought in a similar manner in later times. I have however done more than declare my sentiments on this point. I have been enabled, in consequence of my office, as one of the Council of the Royal College of Surgeons, to aid in carrying them into execution, with respect to those gentlemen who have of late years entered the profession, and intend to become members of that body. Since the year 1835 they have been obliged to follow the practice of the physician for a year in an hospital, after a reasonable preliminary study in the shop of the apothecary; and if any portion of blame, or of credit, is due to the proposers of a measure, however small it may be, that small portion—be it of censure, or approval—is due to those who acted with me.

Wounds penetrating the walls of the chest, and implicating any part, or portion of its cavity or contents, are among the most dangerous of injuries; and require in their treatment a more careful attention, and a greater extent of knowledge, than most others which befall mankind. The means which the improved methods of auscultation have afforded, cause the progress of the symptoms which follow, to be less obscure than formerly, and lead to a less doubtful practice; whilst they render a knowledge of this branch of medical science an essential part of the education of a surgeon who is desirous of attaining a complete acquaintance with the treatment of diseases, and injuries of the chest—information withheld from me in former days, in those cases to which I shall principally allude, and the state of which I had to conjecture, from those pathological facts which dissection had in other instances demonstrated, but the progress of which I could not always distinguish, with anything like that degree of certainty which auscultation affords at the present moment. Careful and lengthened observations, which became in time experience, had pointed out the great and leading practical facts which accompanied and followed these injuries; and the treatment was perhaps as good, although more empirical, in the last days of the war in the Peninsula, as it is at the present moment. I cannot now add practical recommendations other than those which I have been in the habit of recording in my lectures during the last thirty years; but it is possible to render the causes and the symptoms which made these recommendations necessary, more apparent.

During the war in the Peninsula, and in France, the French cavalry, although always superior in number to the British, did not often avail themselves of that superiority, to attack in the manner they are reported to have done on other great continental occasions; and wounds from swords or lances were, therefore, comparatively rare during that eventful war. Wounds from bayonets were not more common; for, although much has been written, and more stories have been told (indeed, so often told, that the people who relate, actually at last believe them) about charging with the bayonet, their crossing and locking, the heroic efforts made by the conflicting parties, and so forth, that it might be supposed these wounds were of frequent occurrence; the fact is, however, otherwise. That regiments do advance some in line, some in column, with the intent to charge with the bayonet, is indisputable; that other regiments do intend to meet them, or to receive the offered charge, is no less true. Nevertheless, they generally do neither one thing nor the other, but by some means, or accidental causes, of which I do not presume to give any account, one party usually thinks discretion the better part of valour, and walks silently and angrily away. The unfortunate fellows who cannot get off fast enough, do occasionally suffer a little in the scuffle which takes place; and here and there small parties may engage in personal conflict: but be the matter as it may, it rarely happens that many are hurt by the bayonet, or, if they are, they are killed outright, and do not come under the observation of the surgeon. As duels with swords are rarely fought in England, and stabbing does not prevail to any extent, wounds from what the French term "*armes blanches*," have always been less common than those from pistol, or musket-balls.

Incised or punctured wounds, from swords, bayonets, or knives, require a mode of treatment essentially distinct, on many points, from gunshot wounds, especially in the commencement. On this early treatment so much depends, that details of the more serious or more important cases are rarely found among the records of injuries sustained on the field of battle, where so much is often to be done, and so few are to be found to do it. They are met with among the records of isolated cases which have occurred, from time to time, to medical men, who have had leisure to bestow upon them, and ability to direct its proper application; a remark especially exemplified in the "*Clinique Chirurgicale*" of the Baron Larrey.

The simplest of the more serious results from injuries not penetrating the chest is the occurrence of inflammation either of its lining membrane, giving rise to what is called *pleuritis*, or of the substance of the lung, termed *pneumonia*. These affections are rarely met with separately after wounds, and more particularly the latter, without implicating the former, constituting what has been named *pleuro-pneumonia*.

Case 1.—I stood immediately between some soldiers on the 17th August, 1808, in the act of leaving the village of Colombeira to ascend the heights of Roliça. One who was shot in the leg, jumped up three or four feet, and made a considerable outcry. A second was struck at the same time by a ball on the shoulder, which did not penetrate, but gave him great pain. A third received a ball on his buff leather belt, on the right breast. The noise made by these two blows was very distinct. This man fell, and was supposed to be killed; the ball had, however, only gone through his belt, and made a mark on his chest, over the cartilage of the fourth rib, the hardness and elasticity of which had prevented further mischief. He recovered in a short time, spit a little blood in the night, and after a large bleeding was enabled to accompany me on the 20th to Vimiera, ready for the fight next morning, from which he escaped unhurt.

Case 2.—A soldier of the battalion of detachments crept up to me on the hill of Talavera on the evening of the first attack of the French advance, who had driven them over it. He had been struck on the breastplate by a ball, which, as he believed, had gone into, if not through his body. He was as white as a sheet, and desperately frightened. On opening his coat, I found it had struck against the breastplate, and had made a round red indentation on the skin, without going deeper: the breastplate had saved him. I did not see him again for several days, until after crossing the bridge of Arzobispo, on the retreat to Truxillo. He was then engaged in disembowelling a fine fat hog, amongst a herd of which we had unluckily for them just fallen. He recognised me at once, said he had been as I told him, more frightened than hurt; that he had been bled largely and well physicked, and after a couple or three days had thought no more of it. I am bound to add, that in gratitude he offered me a part of a leg, which, having nothing to eat, I could not but accept. It supplied a dinner for three (besides myself,) who are now no more.

Case 3.—A soldier of the 40th regiment slipped from the ladder on which he was attempting to scale the wall near the great breach of Badajoz, the night the place was taken, and fell on his cartridge box, which hurt his left hypochondrium so much as to render him unable to move for some time. The next day, the 7th April, he suffered great pain at this spot, and on the 8th was so much worse as to seek advice at the Hospital tent. The ribs were not broken, but the part injured was painful to the touch, the difficulty of breathing considerable, with a hard cough, and little expectoration. Pulse 90, skin hot, appetite gone, tongue white.—V.S. ad ℥xvj. and aperients. 9. Better, pain less, expectoration more in quantity and viscid.—V.S. ad ℥xii. antimonials. 10. Pain still felt on coughing, expectoration reddish, difficulty of breathing greater.—Pil. Cal. et Antim. c. Opio; V.S. ad ℥xvj. 12. Better in every respect. He gradually recovered, his mouth becoming slightly sore, from what was manifestly an attack of pneumonia.

Case 4.—A gentleman, in 1835, fell from his shooting pony on his powder horn, which bruised his right side from the seventh to the last rib, and, as he said, knocked the breath out of his body, and hurt him so much as to render him incapable of walking from one room to another, from pain in the side, back, and thigh. No bones were broken. The pain, on the second day, was augmented on breathing and on attempting to cough, and which spirituous frictions did not relieve. The third day he was purged and blooded to sixteen ounces, which gave some relief, but as the symptoms increased on the fourth day, he was more carefully examined. His right side could not bear pressure. The respiratory murmur was distinct, but accompanied by a crepitating rhonchus under the part injured. Cough troublesome, expectoration mucous, viscid and of a reddish tinge. Antim. tart. and sulphas magnesiæ every four hours. V S. ad ℥xiv. On the fifth day, the symptoms being little altered, he was cupped on the part affected to fourteen ounces. On the sixth day the pain was only felt on coughing, or on drawing a very full breath; expectoration redder and thicker, pulse quicker. The rhonchus was quite as distinct.—V.S. ad ℥xij., and the medicines to be continued. After this he quickly recovered, and the natural respiration became distinct.

Case 5.*—A mason, 32 years of age, fell from the height of seven feet on his back, on the 12th of July, the posterior part of the skin of the right hypochondrium being grazed; the fall did not prevent his continuing to work. On the morning of the 13th, on awakening, he felt a pain on this part, which was increased by every movement of the body, and was accompanied by general disquietude, cough, dyspnea, and loss of appetite. The 14th and 15th he remained in bed, the symptoms continuing. On the 16th he was admitted into the Hospital La Charité, and was bled. On the 17th the pain was great, the cough very troublesome, the breathing short and quick. Percussion gave in front its full sound; it could not be effected behind from the pain it occasioned The respiratory murmur under auscultation was clear and strong before and on the sides, but to the right and behind, in nearly all the extent of the inferior lobe of the lung, a crepitating rale was distinguishable. The expectoration was viscid, transparent, and of a greenish colour; the pulse was scarcely frequent, the skin cool. The nature of the expectoration, and the auscultation declared the existence of pneumonia.—V.S. A poultice to the side. A slight sweat took place in the evening.

18. Pain less, respiration freer; otherwise the same; twelve leeches to the pained spot on the side.

19. Pain only felt on coughing, on percussion, and on drawing a deep respiration; rather more fever. The expectoration more viscid, and rust coloured (rouillé), the dyspnea greater, the crepiting rale continued. It appeared from these symptoms that whilst the pleurisy diminished, the inflammation of the parenchyma of the lung increased.—V. S. ad ℥x, which gave a sensible relief.

20. Breathes freer, expectoration less viscid, crepitating rale stronger, with a mixture of a slight natural pulmonary expansion sound; fever less. In the course of the day the nose bled freely.

21. An evident amendment of all the symptoms, and from the 22d to the 23d complete convalescence.

The viscid, rust coloured expectoration, and the crepitating rale, disclosed the existence of pneumonia in the first instance, which the absence of fever might have rendered doubtful; and as the stitch or pain indicative of pleuritis diminished, the signs of pneumonia became more marked.

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* Andral, Clinique Medicale. Maladies de Poitrine. Obs. 7, Tome 1.

Case 6.—Lieut. Cooke Tylden Patterson, of the 43d Light Infantry, was struck on the left breast by a musket ball, on the morning of the 15th July, 1813, in front of the village of Vera, in the Pyrenees. He sprung two or three feet in the air, and fell on his back breathless, and as if killed. When he had in some degree recovered from the blow, he found that his life had been preserved by an accident. Whilst waiting the order to advance, he had been reading Gil Blas in Spanish, and on receiving it, he had hastily put the book in the breast pocket of his coat. The ball had struck this, but unable to penetrate it, had fallen on the ground at his feet, completely flattened on one side, and marked with the impression of the braid of his coat. A piece of the cover of the book, about the size of half a crown, was driven in, and the leaves throughout were indented by the ball. It was some days before the effects of the blow entirely subsided.

Case 7.—A stout man, 53 years of age, fell on the stairs with an iron box in his hand, on Tuesday the 7th of September, 1847, and bruised the left side immediately over the ends of the short ribs, which gave him great pain at the part, and over the cartilage proceeding to be attached about the eighth rib. On the 8th he was bled freely; aperients and saline medicines were given, and a bandage was applied tightly around the body. On the 9th the pain became greater, the breathing more difficult, and a crepitating rhonchus was heard underneath both the spots complained of. On the 10th I saw him for the first time, in consequence of the crepitation or crackling of the lung, resembling in some degree the crepitus of a fracture, and as the breathing was very difficult, removed the bandage, which gave him relief. Pulse 108; cough troublesome, with some thick mucous expectoration. The crepitating sound could no longer be heard, nor the vesicular murmur under the two spots, which still gave him great pain on being touched. Blood was drawn until relief was obtained; about twenty-four ounces were taken away, and three grains of calomel, with two of James' powder, and one-third of a grain of opium, were given every four hours. On the 11th he was in all his feelings better; the pain had subsided, the breathing was easier, more natural, and clearer in every part except the two spots before mentioned; bowels open, cough troublesome. Continue the calomel and increase the opium at night. On the 13th the gums were slightly sore, and his symptoms had all diminished in intensity. 14. Cough alone was troublesome; respiration distinct, except under the parts injured, and there even some indistinct murmur could be perceived. From the 16th to the 24th the mouth was kept moderately sore; blisters were afterwards applied on the parts injured, and he gradually recovered.

Case 8.—A soldier of the 97th regiment was struck, at the unsuccessful assault of Fort Christoval, opposite Badajos, by a musket ball, which went through his brass breastplate and coat, drove his shirt into his skin, and against the sternum, which it was not able to penetrate. He fell, and was supposed to be killed; but he soon recovered his wind, got up, and ran to the rear as fast as he could. The ball was found flattened between his shirt and coat. The part of the chest was very black next day when I saw him, the spot struck by the ball being much bruised. It was necessary to bleed him largely. All difficulty of breathing was then removed.

I have seen very many instances of persons struck in different parts of the chest, nearly similar to those above stated. In some they have been fortunate enough to escape with the blow and the alarm; in others a little spitting of blood ensued, and, as in the preceding cases, more or less inflammation followed. When a ball actually makes a wound, rather than bruises the part, internal inflammation is a consequence perhaps more rare.

Case 9.—Major Lightfoot was struck by a musket ball on the left breast, which went through his clothes, the integuments and the outer part of the great pectoral muscle, and slanted inwards for three inches towards the sternum, to which distance its track could be followed. It was evident that the ball had neither lodged, nor penetrated, for no serious symptoms ensued, and I had with him as little doubt that it had been ejected the way it went in by the elasticity of the cartilages of the ribs near the sternum.

This sort of injury, which I have seen in many other instances, is, at the moment, as curious as it is interesting to the patient.

The nine preceding cases shew that inflammation of the pleura, and sometimes of the lung itself, is a common consequence of a severe blow. The following case of its extending even to gangrene is recorded by Dr. Stokes:—

Case 10.—A middle aged man was attacked with symptoms of pneumonia, in consequence of a contused injury of the right side. From these he partially recovered, when he was thrown from a car, and received a second injury on the same side. Cough, with a dark coloured offensive and occasional hæmoptysis, set in. He was admitted into hospital, in the seventh week of his illness, with extreme prostration. The countenance was of a leaden hue; the respiration seventy-two in a minute; breath fetid; cough constant, with expectoration of a yellowish white purulent matter. By the stethoscope, a large cavity was detected in the right lung. He died four days after admission. *Inspection.*—A vast gangrenous abscess occupied the whole posterior part of the right lung, and contained a large, moist, and soft slough, of an extreme fetor; the upper part of the cavity was lined with a distinct layer of coagulated lymph. Dr.

Stokes gave in this case, and thinks the best remedy in gangrene of the lung is chlorine, in the shape of chloride of lime and soda, combined with opium.

In order to understand, or to become in any way acquainted with the changes from the natural structure which are going on under derangement in the chest, from even simple injuries, it is necessary to have recourse to auscultation, and sometimes to percussion, if the external parts are not too tender. Under all circumstances both sides of the chest should be examined, whilst perfect silence and quiescence are observed, the stethoscope being preferable, when the ear has been properly trained to its use.* As the ordinary breathing of an individual is rarely sufficiently strong to enable the auscultator to hear with sufficient distinctness, the patient should be desired to inspire fully and more quickly than usual, without however much effort, and without noise from the mouth or nose; or retaining his breath. The inspiration and the expiration are both to be carefully observed. When the patient is really awkward, and cannot respire in the manner necessary to convey sounds to the ear with the required precision, he may be desired to cough, each shock of which will be preceded and followed by a long inspiration, when the desired object may be attained, which in some persons it is difficult otherwise to accomplish.

Respiration being effected through the medium of the larynx, the trachea, and the lungs, the sound derived from the passage of the air is different in each. When the ear is firmly and equably applied to the chest of a healthy young person, a very distinct and long-continued sound is heard at the moment of inspiration, and another at that of expiration. This is called the *vesicular*, or *respiratory murmur*, and is dependent on the air fully permeating and distending the air-vesicles of the lung. It has been almost poetically compared to the sound of a gentle gale rustling in a thick summer foliage, to the whisper of a retiring wave on a sandy beach in a calm day. It is soft, scarcely sonorous, equable, and during inspiration, continuous.

When the ear, or the stethoscope is applied in the situation of the great bronchial passages, as over the first bone of the sternum, under the clavicle, in the centre of, or between the shoulder blades, a different sound is usually, but not always distinguishable, when the patient breathes fully, arising from the passage of the air through these bronchial tubes. It is compared to the noise made on blowing through a reed or quill, and is called, *bronchial or tubular respiration.* When heard in other parts of the chest, it is generally regarded as a morbid sound. If the stethoscope is applied over the trachea, the sound is louder, rougher, and more intense, and is called *tracheal* respiration. On the larynx, it is louder, hoarser, and rougher still. It has been compared to the hissing sound caused by blowing into a cavity through a tube of large calibre, and is called *laryngeal* respiration. In childhood the respiratory murmur is louder than in adult persons, arising probably from the greater activity of the lungs in young, than in elderly people. This is called, and especially when perceptible in adults, *puerile respiration*, as opposed to their ordinary, or what in old persons may be called *senile;* and is more marked during inspiration.

The length of the sound in inspiration, as compared with that of expiration, has been said by Fournet to be as five to one. Barth, Roger, Andral, Hughes, &c., consider it to be as three to one, or five to two. One is louder and longer than the other, a difference requiring attention, from the circumstance, that morbid sounds of great import are heard in inspiration, which do not prevail during expiration. When any other difference is perceptible between them, so that they more nearly resemble each other in duration, or in intensity, or when expiration is prolonged, some structural alteration may be suspected in old persons, some disease in young ones. When little or no respiratory murmur can be heard after symptoms of inflammation have existed for some time, the case is very serious, implying that effusion into the cavity, or that condensation of the lung has taken place to a considerable extent.

The number of inspirations in the adult and elderly person varies from eighteen to twenty-two, in a state of health. From twenty-two to twenty-six in children. The stroke of the pulse is generally as four to one. If the inspirations are eighteen the pulse will in general be seventy-two. Both may be slower, although they are often more frequent under disease. When the breathing is slower, it commonly indicates some affection of the nervous system; when very rapid, some important lesion within the chest.

Ordinary inspiration is effected in health by a general enlargement of the chest, which takes place by an elevation little remarkable upwards, and by its enlargement from before backwards. The diaphragm at the same time descends, drawing the lung downwards with it. When the breathing is hastened, the elevation of the chest is more evident. When the breathing is forced to its utmost, the thorax is manifestly enlarged in every direction.

Van Swieten, in the second vol. of his Commentaries on Boerhaave, page 95, Edinb. 1776, says Dr. Houstoun, shewed him a little dog, both sides of whose chest he had opened three days before, and which ran about briskly. Having examined these wounds, he saw that the lungs did not adhere, and that a wax candle was extinguished by the air blown out from the wounds. After making some horrible experiments on other living dogs, he came to the conclusion, "that wounds penetrating both sides of the thorax, and admitting the air, are not speedily and certainly mortal, unless the openings exceed in size those of the glottis."

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* For extended views and explanations of the practice of auscultation, reference may be had to the able works of Messrs. Barth and Roger, Paris, 1841, and to the Clinical Instruction in Auscultation, by Dr. Hughes. London, 1845.

Dr. D. Williams, of Liverpool, in 1823, apparently unaware of the atrocious cruelties committed by Van Swieten on this point, instituted other experiments on dogs for a similar purpose, which he published in the *London Medical and Physical Journal*, and came to the same conclusion.

"That the lung of one side will not collapse to any extent after an opening has been made into that cavity, provided respiration is duly carried on by the opposite lung, and that the lungs possess a peculiar motive power dependant probably on their vital, as well as organic, elasticity." He further shewed that a dog would recover after an opening of an inch and a half long had been made in each side of his chest, provided the animal be allowed to run about, with as free use of his respiratory organs as can then be effected.

Dr. Williams was also induced to apprehend from his experiments that a sound lung never fills the bag of the pleura, particularly towards the diaphragm, at least during ordinary respiration; and he was led to this from not being able to wound the lung in a living dog, by pushing a knife into the chest immediately above the eleventh rib. I requested Mr. Quekett, the Assistant-Conservator of the College, to repeat this experiment on some sheep at the moment of their being killed. He stabbed five sheep immediately on their throats being cut; in three of these, in which the knife was passed between the tenth and eleventh ribs, both the lung and diaphragm were wounded. In the fourth, in which the puncture was made between the seventh and eighth rib, the lung only was wounded; and in the fifth, in which the knife was passed between the last two ribs, the diaphragm only was penetrated, the knife passing through it into the abdomen. He therefore concludes, from these and other observations, that the base of the lung is always in contact with the surface of the diaphragm.

In ordinary expiration the chest diminishes in size. The ribs which had been raised recede, by the elasticity of their cartilages and by the return of the ligaments to their state of rest; the elevating muscles become relaxed, whilst others belonging to the lower part of the trunk and abdomen contract. The diaphragm is relaxed and pushed upwards by the viscera of the abdomen, pressed upon by the muscles of its wall, if it should not be drawn upwards by the attraction of the lung, which, when distended, endeavours by its elasticity to return upon itself, and to occupy less space than the capacity of the chest will afford. The lung covered by the pleura pulmonalis, and invested by an elastic, special and transparent membrane, is composed of an innumerable number of air vesicles, the largest being equal in size to the fourth part of a millet seed. These air vesicles, crowded together, each communicating with a fine bronchial tubule, are separated from each other and into groups by a condensed cellular tissue, thicker where it surrounds these lobules which alternately form, when aggregated together, a lobe, whence it is called interlobular tissue. An artery and vein form a very minute net-work around each vesicle.* These vesicles may become filled by water; and when dilated by air, constitute what is called emphysema of the lung. The lung is in man constantly applied to the internal surface of the chest. The pleura or serous membrane covering the lung is closely applied to the pleura lining the wall, and one surface glides upon the other, moistened by a secretion in just sufficient quantity to effect this object. If the intercostal muscles of a young animal are removed to a sufficient distance, the lung and the diaphragm may be seen applied to the inside of the pleura lining the rib, and *ascending* and *descending* in concert, the lungs moving vertically, not horizontally.† The diaphragm ascending, and covered by its pleura, is in a similar manner applied to the lower part of the wall of the chest, which had been filled by the lung during inspiration. After death the lung remains applied closely to the pleura, and recedes on an opening being made into that membrane, provided no adhesions exist to prevent it.

Dr. Stokes believes himself to be the first who pointed out an elastic tissue covering the lung, and lying between its substance and the pleura covering it. Mr. Gulliver demonstrated the existence of a yellow elastic tissue, like that found in the coats of arteries, not only in the interior of the lung around the air-cells, but that it was identical with the external elastic capsule, which is particularly strong in the horse and the elephant. Camper, Stukely, and others, had already shewn that, in the elephant, the lungs were kept in close apposition with the sides of the chest and diaphragm, by means of a connecting membrane extending from the pleura pulmonalis to the pleura costalis. Mr. Quekett informs me, that microscopic observation has demonstrated that this membranous structure is, in reality, a normal elastic tissue, and not an adventitious membrane, the result of inflammation.

Mr. Quekett is, then, disposed to conclude that, whilst no pleural cavity really exists during life, which cannot be the case in the elephant; that, in this animal, the connecting elastic tissue, aided by a delicate areolar tissue, assists materially in inspiration, as well as in expiration.

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* Reisseisen de Structura Pulmonarum.

† See Regnaud, Journal Hebdomadaire, tome 5, 1829.

When inflammation of the pleura takes place, the gliding motion is not effected silently, but with a peculiar noise, called by the French *frottement.* When the lung is inflamed, the respiratory murmur is changed in that part, or is overcome by a peculiar sound, which can be distinctly investigated by the ear--*rhonchus crepitans.* Hence the great value of auscultation, the discovery of which has immortalized the name of Laennec, and enabled the physician to enquire more accurately into the nature of the symptoms which take place, from their commencement to their termination in resolution, or during their progress to destruction of the organ.

Auscultation of the voice can also be effected and discloses peculiar sounds in the natural state, which are also observed during certain stages of disease, when they sometimes mark considerable, and sometimes permanent derangement of structure. They are called, in general terms, pectoriloquy, bronchophony, and ægophony, which latter is always a sign of disease.

Perfect *Pectoriloquy*, or chest-talking, occurs from the sound of the voice, in a healthy person, being heard when he speaks, if a stethoscope be applied to the larynx, the ear of the auscultator not applied to the instrument, being closed by the finger. It will, under these circumstances, be as distinct as if the lips of the speaker were applied closely to the ear. If the stethoscope be placed in succession over the trachea, near the sternum, the voice will not be conveyed in so clear and distinct a manner. This is called *imperfect* pectoriloquy. If the stethoscope be now removed to the first bone of the sternum, or to the part over the cartilages of the second and third ribs, or to the inter-scapular region, a different sound will be heard when the patient speaks, which does not appear to pass through the instrument; it is loud, but distant, and not distinct. This is called *bronchophony*, or *bronchial sound.* These sounds all, however, merge into each other, and may be considered as varieties of the same sound, more or less distinct, or recognizable, by one auscultator than another.

Percussion is an aid from which, in particular cases—such especially as pneumo-thorax and empyema—much information may be derived. It is however inferior to auscultation, as a whole, and not so readily applicable in cases of wounds and injuries, in which it would sometimes cause great pain, and more inconvenience than would be compensated by the information to be derived from it, unless the first symptoms had been subdued. It was first introduced to general notice by Avenbrugger, physician to the Spanish hospital at Vienna, in 1763, in a work entitled "*Inventum novum ex Percussione Thoracis,*" *&c. &c.* A translation into French was published in 1770, by Roziere de la Chassagne en Montpellier; and another by Corvisart, in 1808. In England, physicians were not unmindful of Avenbrugger's labours before the time of Corvisart; and in 1799, and 1800, I frequently assisted the late Dr. Rowley in his examinations of the chest after this method, particularly in cases of hydrothorax, few of which escaped the investigation which percussion afforded.

# LECTURE II.

*Inflammation of the pleura; Symptoms; Effusion of fluid; Its danger in wounds of the chest; Signs indicated by auscultation and percussion; Inflammation of the lungs; Symptoms; The three stages of pneumonia; Signs of pneumonia discoverable by auscultation; Formation of false membranes in pleuritis; Compression of the lung in cases of pleuritic effusion.*

It is not my intention, in the following observations, to give a history of, or even the whole of the symptoms and the consequences of inflammation of the pleura and the lungs. It would be out of place. I am merely desirous of drawing attention to such of the principal facts as it may be necessary to consider when these inflammations and their consequences are caused by wounds or external injuries.

Acute Idiopathic inflammation of the pleura usually commences by rigors, preceded perhaps by some signs of general uneasiness, which soon become those of great febrile excitement. Pain is early felt in the side in the course of the sixth, seventh, and eighth ribs, on the point corresponding generally to the seat of the inflammation. It is usually sharp and darting, is called a stitch, occupies rather a small space (the *point de coté* of the French) and is always increased by drawing a full breath or by coughing. The breathing is short, from the disinclination to fill the chest, which increases the pain; and it is hurried, and sometimes takes place as if by jerks, from the necessity for its repetition, in consequence of the smallness of the quantity of air admitted at each attempt. When the attack is very severe, the patient tries to breathe with the healthy side only, and the lower ribs of the affected side are moved but slightly, and with evident caution. If the inflammation has been caused by extreme violence, pain will be also felt at that part in particular. When acute inflammation supervenes on a part already in a morbid state, it will necessarily be felt at the spot affected, although it is not always present, unless sought for by a cough, or by a deep inspiration.

When inflammation has affected the pleura covering the diaphragm, and especially when caused by external violence, the pain will be felt lower down, so as to lead to the suspicion that it is also abdominal. When jaundice supervenes, as it has been known to do, it must have been an accidental circumstance, or from extension of disease through the substance of the diaphragm, as is occasionally seen in wounds implicating the chest, the diaphragm, and the liver, and complicating in these instances the original disease or injury.

A cough is not a constant accompaniment of the first stage of disease; and when present, it is usually dry, slight, infrequent, and does not attract attention, unless accompanied by a thin mucous expectoration, indicating the presence of a disposition for bronchitis, if frothy; for pneumonia, if reddish. The patient usually lies on his back whilst the pain is severe, and has a great indisposition to turn fully on the affected side, although he inclines towards it. At a later period, when effusion has taken place, he turns on this side to relieve the difficulty of breathing, caused by the pressure of the fluid on the sound lung through the bulging of the mediastinum; but the manner of lying, or *decubitus*, as it is called, is of little importance, and should be subservient to the feelings of the patient, who is sometimes only comfortable when raised to nearly an erect position.

When the complaint is not subdued at an early period, an effusion of serous fluid takes place, more or less in quantity, according to circumstances. In from twenty-four to forty-eight hours the whole cavity of the side affected has been known to be filled, giving rise to symptoms dependent on the degree to which the effusion has taken place; and this is the evil which in injuries penetrating the cavity of the chest is most to be feared. When the external wound has been closed, or is so partially closed as not to allow its escape, it is commonly the immediate cause of the death of the patient. Its formation and early evacuation are therefore the most important points to be attended to in these particular cases.

The respiratory murmur, discoverable by the ear or by the stethoscope, becomes fainter as soon as the pain prevents the ordinary distension of the affected side of the chest, and diminishes the quantity of air which usually penetrates the lung in any given time. As soon as a thin layer of fluid commences to be thrown out between the pleuræ, this murmur becomes fainter, and as soon as it is complete this sound ceases. If the patient can bear percussion, the side affected yields a dull dead sound, instead of the ordinary clear sonorous one of health. The position of the patient, when erect, by causing the fluid to descend, may allow of the respiratory murmur being heard at the upper part of the chest, although it may only be perceived in front, but not behind, when he lies on his back, until the cavity is filled, when this sound altogether ceases. At the spot in the back corresponding to the root of the lung, or at any other point at which previously formed adhesion may retain the lung against the wall of the chest, some respiratory murmur may yet be distinguished, until this part of the lung shall also have yielded to the general compression, so as to be temporarily impervious, or have become solidified, under the continuance and the extension of disease. Whilst this is taking place in the affected side, the other lung is called upon to make up the work of aërification of the blood; it labours harder, its functions become more energetic, and that side of the chest is more distended; the respirations become quicker, fuller, and louder, and the vesicular murmur is said to resemble that, of a child,—to be *puerile*.

When the lung begins to be compressed by the circumambient fluid, and the respiratory murmur ceases, a peculiar modification of the respiration through the large bronchial tubes, may be heard, constituting *bronchial* respiration. It occurs in pneumonia, in pulmonary apoplexy, and in tubercular disease when the lung is solidified. When the *voice* is heard through the stethoscope in these complaints, the peculiar sound emitted is called *bronchophony*.

In pleuritic effusion, the voice when carefully examined, sometimes obtains another character, of comparatively little importance, called *ægophony*, a sound, which may be easily confounded with pectoriloquy and bronchophony, of the latter of which it is a modification more often alluded to than observed. Laennee, who first described it, says, page 70, tome 1, Traité de l'Auscultation, "Simple ægophony consists in a peculiar resonance of the voice, which accompanies or follows the articulation of words. It appears to be sharper than natural, more acute and somewhat silvery, vibrating as it were on the surface of the lung, more as an echo of the voice than as the voice itself. It rarely enters the tube of the stethoscope, less frequently traverses it completely. It has besides another peculiar character, which is constant, and from which I have taken its name. It is a trembling, bleating, or shaking sound, like that of a goat, the tone of which animal it greatly resembles. When it occurs near a large bronchial tube, as in the root of the lungs, a more or less marked bronchophony is often superadded," thus giving rise to various modifications of voice and tone, which Laennec considers to resemble more particularly that made use of by the Polichinello, the Punch of the streets. This sound may pervade the whole side; it is usually, however, most distinct near the inferior angle of the scapula, the patient being erect. It only exists where the effused fluid is small in quantity, is never a dangerous symptom; and its return, after it has been present and has disappeared, is a sign that a part of the effused fluid has been removed. It is a sign principally of value in distinguishing between pleuritis and pleuro-pneumonia and pure pneumonia, in which latter it is not heard, as no fluid is thrown out on the pleura.

In pneumonia, or inflammation of the substance of the lung, as distinct from any implication of the pleura, which however most frequently obtains, after blows on, and in cases of penetrating wounds of the chest, the symptoms differ. The ordinary febrile symptoms are similar to those of pleurisy, only more intense, and usually precede for a day or two the local symptoms of difficult respiration, pain, and cough. The dyspnea varies in different people. In some, it is only a slight embarrassment of breathing, which is partly removed by accelerating the number of the respirations, which are augmented from twenty to thirty, forty, and upwards; in children to sixty and seventy, marking a great degree of distress and of extent of inflammation, from which, when they are so frequent, persons rarely recover. The patient can scarcely speak or lie down, and is obliged to be supported in that which he finds to be the least uneasy position. Pain is not always present; its absence, however, cannot be relied upon as indicating any particular modification of disease, and Andral affirms that it is only absent when the substance of the lung is affected, and not the pleura. That pain is not a necessary concomitant of pneumonia is admitted, but that it is usually present, and with great intensity, in many cases, cannot be doubted. When present, it is usually an early symptom, deep seated below the sternum, under the breast, extending to the scapula. When in the sides, it is more acute and fixed, and is probably conjoined with the pain of pleurisy.

The pulse is quick and sharp, occasionally full and hard, at the commencement of this complaint in young and healthy persons, although it is sometimes small and weak from the beginning, where there is little general power; but this rarely occurs in cases of injury, and is not to be relied upon in them, in opposition to other symptoms.

The *cough* is usually dry in the commencement of idiopathic pneumonia, rarely recurring by paroxysms, and is without any particular indication; it is soon, however, accompanied with a slight mucous expectoration, which, after some twenty-four or forty-eight hours, begins to assume certain and peculiar characters of the utmost importance, as indicating the existence and the different stages of the disease. We owe our information on this point principally to Andral, and it is deserving of the greatest attention. "On the second or third day the expectoration becomes bloody. Each sputum, spit, or *crachat* is composed of mucus intimately combined with blood; that is, not simple streaks or striæ of blood as in catarrh, nor is it pure blood as in hemoptysis. Each sputum is either of a yellow, or rust, or even red colour, according to the quantity of blood intimately mixed with the mucus. These sputa become at the same time tenacious and viscous, adhering so intimately together as to form a homogeneous transparent whole, readily gliding however from the basin in which they are held, on an ordinarily sufficient inclination being given to it. At this period or stage of the disease the sputa adhere strongly to each other, but the mass is not sufficiently viscid to stick to the sides of the vessel. When no further change takes place in the sputa, the inflammation rarely passes beyond the first stage of obstruction or engorgement, or swelling, or the *engouement* of Laennec, Andral, and the French writers. When they attain to a more viscous state, and adhere to the inside of the vessel in which they have been received, the progress of the inflammation to the second stage, or that of hepatisation, may be feared. In almost every case where the viscidity of the expectorated matter increases, respiration becomes null or bronchial. Percussion of the chest yields a duller sound than before, and the inflammation has attained its highest degree. The expectoration, after being some time stationary, changes its character, if the complaint is to terminate by resolution, or by death, or to pass into a chronic state. When by resolution, the redness and viscidity gradually diminish, and at last disappear. If the rust colour and the viscidity should return, there has been a relapse, and the reappearance of the other symptoms prove it. When the inflammation is of the most serious nature, and about to terminate fatally, the expectoration diminishes, and at last ceases. In some it only diminishes because it cannot be discharged, and accumulates in the trachea, the larynx, and the bronchi, until the patient is destroyed. In some rare cases the matter secreted is spit up nearly to the last, and in others, still rarer, the approach of death in the last stage is characterised by a brown expectoration which cannot be mistaken for either of the others which preceded it. If the pneumonia passes into the chronic state, the expectoration becomes yellowish, or somewhat greenish, and at last is purely catarrhal.

Delirium is not an uncommon symptom, when the inflammation of the lung is intense in persons of powerful constitutions, particularly during the exascerbation of fever in the night. It yields with the others, when relief is obtained. When, however, it comes on at a later period of the complaint, or when the accompanying fever is not purely inflammatory, and in persons weakened by exhaustion and privation, it is usually a fatal symptom if at all continued.

When mild it often occurs after repeated and efficient bleedings, which have subdued but not entirely removed the disease, and yields to opiates and gentle stimulants, which also remove the pain, which sometimes however, emains in a milder degree than before.

The ear, or stethoscope, applied to the surface of the chest opposite the affected part, which must thus be sought for, if not indicated by pain, discovers, soon after the commencement of the disease, that the natural murmur cannot be distinctly heard, having been at first partly obscured, and after a time entirely superseded by a peculiar noise, called by Laennec *rhonchus*, or *râle crepitante*, the crepitating or crepitous rattle or rhonchus of English authors. In its purest state it has been likened, by Dr. Williams, to the sound of a lock of hair rubbed close to the ear; by Andral, to that made by rumpling a fine piece of parchment; by Laennec, to that which is produced by what under ordinary circumstances is called the crepitation of salt, when scattered in small quantities on red-hot coals. The dry sound of the burning salt is accompanied by a modification, dependent on the humidity of the part from which it proceeds; which is presumed to depend on the inflammation being confined to the air-vesicles of the lung, partly filled with mucus, whilst the small terminations of the bronchi which communicate with them, are also compressed by the swelling of the surrounding parts, and thus by preventing perfect freedom of inspiration, give rise to this abnormal or peculiar murmur. This crepitating rhonchus is heard at first in a small part of the lung, generally at the lower, rather than at the upper, part; and marks the first stage of the disease. The opinion of Laennec as to the rhonchus crepitans being an accompaniment of the very first stages of inflammation of the lung, has been doubted, as it has whether effusion accompanies the first stage of inflammation of the pleura; and, in all probability, some change must precede, in order to give rise to it. As it is, however, the first sign which can be readily perceived, it may be admitted in practice as denoting the first stage. Dr. Stokes, however, believes that it is preceded by a *puerile* respiration, which is an earlier sign of the commencement of the complaint. This crepitation is not of long continuance; the vesicular murmur is either restored, or the crepitating rhonchus ceases to be heard, in consequence of the second stage having commenced, or that of hepatisation, in which the small air-vesicles are no longer pervious; and the sound of the breathing, which is now heard, is that of the air more forcibly driven into the larger bronchial tubes causing *bronchial respiration*, which is described as altogether different, being no longer vesicular, or crepitating, but whiffing, like that caused by blowing forcibly through a quill, or as if little gusts of air were blown in, or blown out. The voice betrays to the ear of the auscultator another sign; it descends into the pervious bronchi, and being conveyed to the ear through the solid lung, gives rise to that peculiarity of voice which is called *broncophony*, a correct knowledge of which, as of many other points of auscultation, can only be acquired by repeated observation.

When the inflammation of the lung is confined to a small and deeply-seated spot, auscultation may not reveal the evil until its extent has been increased; or it may possibly be overlooked, through the sound part of the lung becoming more active, and giving forth, in consequence, a stronger and more puerile breathing, which misleads the listener.

When the vesicular murmur cannot be heard, when the *rhonchus* or *crepitating râle*, or sound, is not present, and bronchial respiration and broncophony can only be distinguished, the case is one of great anxiety and danger. The second stage of hepatisation is passing into the third or purulent infiltration, of which auscultation shews no further signs, although the matter secreted may be expectorated, in proof of what has taken place. Pus thus formed, it was first declared, and it is still steadily maintained by some of the best French writers, is not deposited in the form of abscess, but infiltrated in the parenchymatous substance of the lung, finding its way into the larger bronchial tubes, or is poured out from some parts of their secreting surface.

Upon this point, M. Laveran comments in the 57th vol. of the *Memoires de Chirurgie Militaire*, for 1844, having related a case in which an abscess had formed of the size of a nut, a second in which it was the size of a small egg, and a third in which there were several small abscesses communicating with each other. Admitting that these abscesses rarely occur, he attributes that rarity to the parenchymatous tissue of the lung being fibrous rather than cellular. M. Grisolles in his able work on pneumonia, has collected twenty-two cases of abscess in the substance of the lungs, rendering its occurrence no longer a disputable point. The accuracy of the statement to the contrary I have always been disposed to doubt. from my own repeated dissections having proved the reverse.

The effects of inflammation of the pleura are well marked; the first is to diminish, if not to annul, the secretion of the exhalation, or halitus, by which it is lubricated; so that its surfaces can no longer glide without noise upon each other. The patient is often made aware of the difference by some uneasy internal sensation, the auscultator by a rubbing or creaking sound emitted as the inflamed pleuræ, no longer smooth and polished, rub against each other, and become covered by a thick, effused matter, although not actually separated by a liquid. It is a sound which cannot exist after separation has taken place by the intervention of a fluid, or after adhesions have formed; it is, therefore, an early and transitory sign, is frequently interrupted, and returns, as if by jerks, three or four times, repeated in succession. The pleura, when examined, after being attacked by inflammation, shews, at first, but little sign of derangement on its serous surface. It quickly, however, exhibits numberless small vessels, now carrying red blood, which are principally seated in the sub-serous cellular tissue, reddening the membrane more deeply in one part than another. These soon begin to take on a new action, leading to the deposition of coagulable lymph or fibrine, which adheres to the inflamed surfaces. These depositions soon assume the determinate form of very thin layers, constituting what are called false membranes; whilst a serous or sero-purulent effusion takes place, even to filling the cavity of the chest, and which may, or may not be ultimately absorbed. When coagulable lymph is first deposited, and about to form a false membrane, it is soft, of a greyish-white colour, possessing no appearances of organisation. Red points are, after a time, perceived in it, which soon become red lines or streaks, on the surface. This organisation of the lymph does not depend on the period which has elapsed from the commencement of the complaint. It is seen in the first day of the disease in some cases—it is altogether absent in others, and depends much on the state and habit of the patient. The lymph is sometimes deposited in small drops or spots; in others, in patches of a greater or less size, varying according to the extent of the inflammation which has produced them. When a false membrane is once fully formed, it becomes itself a secreting surface, and may go on augmenting its thickness to so great a degree as materially to diminish the cavity of the chest. I have seen the pleura with a solid deposit of this kind much more than an inch in thickness. In general, it is found in distinct layers, super-imposed one on the other; and, whatever may be their thickness, they commonly admit of being separated from each other. The false membranes thus formed, resembling cellular tissue in their properties, may ultimately become cartilaginous, and even bony. When adhesions form between the pleuræ, they become lengthened with time; and although they impede the motion of the lung at first, and may give rise to some uneasy sensations, they gradually become elongated, and give no further inconvenience. The fluid thrown out, independent of the lymph, is serous; it rapidly follows the establishment of inflammatory action, and is often mingled with flocculi of lymph, which are seen floating in it, and is, therefore, more or less turbid, resembling whey. It is often nearly colourless and transparent, particularly after inflammation; when the consequence of injury, it is often tinged with blood, forced out from the capillary vessels of the pleura, or of the false membrane, if not caused by the deposition of the fluid coagulated in the first instance after the receipt of the injury.

The quantity of fluid thus thrown out varies from an ounce to several pints; it gravitates according to the position of the patient, unless when from old adhesions between the pleuræ, it is confined to particular parts. When the cavity of the pleura is free, and the fluid is in quantity, it compresses the lung, and diminishes its size by pressing or squeezing the air out of it; it is thus pressed towards the vertebral column, and so greatly diminished in size and augmented in density, as to be useless for the purposes of respiration. Whilst the lung is undergoing this compression to its utmost, the mediastinum also yields, and bulges into the opposite side of the chest, carrying the heart more or less with it; so that when the left side of the thorax is thus affected, the heart is seen and heard to beat on the right. The diaphragm now yields, in turn, more on the left than on the right side, from the obstacle to its descent afforded by the liver. The intercostal muscles and ribs resist for a considerable length of time, for weeks, the internal pressure; they at last however yield: the ribs may even turn a little outwards, whilst the interspaces in thin persons are said to fill out, so as to render that side of the chest nearly smooth; the size of that side when measured, being larger than the other, in some instances by even two inches, but this rarely occurs unless the fluid within is purulent, and the disease of long standing.

It has been supposed that the deposition of albumen, fibrine, or lymph, in layers, in the formation of false membranes, is consequent on the effusion of the colourless fluid from which they are deposited; and that the change of the transparent to a whey-like fluid, is a precursor of this deposition. But this is certainly not always the case; these false membranes being generally found where death occurs early from wounds of the chest, even when the fluid is transparent, or discoloured red; although it may be admitted that when the pseudo-membranes are thick, or in several layers, the serous fluid is thicker, more turbid, and similar to purulent matter.

That a deposition may take place from a fluid the product of inflammation, which is scarcely turbid, must be admitted; and that from this a deposition of whitish matter may take place, lying upon, but not actually in the first instance adhering to, the part in which it is deposited, cannot be doubted. I have seen this take place in inflammation of the internal layer of the cornea, and of the anterior covering of the iris, after the operation for extracting a cataract; I have also seen it covering the capsule of the lens after injury, rendering it quite white; yet on the evacuation of the aqueous humour by an opening in the cornea, made in one instance, for the purpose of removing a small piece of copper cap, the original cause of irritation, the white deposit was discharged with the aqueous humour, and the capsule of the lens left perfectly transparent.

After a time, and particularly in wounds of the chest, the effused fluid becomes purulent, the lung, compressed to a small flattened surface, adheres to the spine by what was its root, if no other adventitious attachments have retained it in a different position, and the pleura has become a thick yellowish-white, irregular honeycombed like sort of covering for it, as well as completely lining the chest. The serous as well as the purulent effusion are both free from any unpleasant odour, unless a species of gangrene has taken place, when the latter becomes very offensive, and of a greenish-black colour, as well as the substance of the false membranes extending to, and sometimes beneath the pleura covering the condensed lung, into which openings have been even thus made.

In some cases the surface of the pleura is covered with small tubercles, some as large as a filbert; in others it appears to have a reticular or honeycombed appearance; and in particular cases, large irregularities, or excavations, may be observed in it when much thickened, being evidently spots of ulceration, which, if they had proceeded, would have ended by allowing passage to the matter outward, until it formed an external abscess, implicating in all probability one or more of the ribs, and giving rise to an exfoliation, which by being separated internally, might in time be the cause of further mischief, if not previously covered by a thin layer of false membrane. When chronic pleurisy succeeds to a more acute attack, or alternate with each other, and particularly after penetrating wounds of the chest, several layers seem to be laid down one upon the other, until the pleura costalis would appear to have attained in some instances to an inch or more in thickness, and somewhat resembles a solid cartilaginous substance. It is never so thick upon the pleura pulmonalis, nevertheless it is quite thick enough in most instances to prevent the lung from again dilating, the substance of it being generally quite permeable to, although so compressed as to be deprived of air, flattened, drawn upwards towards its root against the mediastinum and spinal column, unless, by some previous adhesion, such course has been prevented, and it adheres, as it has been often known to do, to the side of the chest. As that adhesion may occur in more than one spot, so may the effusions or deposits take place between them, constituting circumscribed sacs. Dr. Roe gives one remarkable instance, in which the fluid contained in the lower part was evacuated by operation, but that in the upper part was only discovered after death, there being between thirty and forty ounces of pus within the general cavity. The lung, instead of being compressed in a healthy state, may have been the subject of previous disease, or tubercles may form in it, or an abscess or spot of gangrene may give rise to a communication between the inside of the lung and the cavity of the chest, into which the air escapes, rendering the case more complicated.

# LECTURE III.

*The changes in the structure of the lung from pneumonia, engorgement, hepatisation, and purulent infiltration; Occurrence and seat of the respiratory murmur during the presence of pleuritic effusion; Great necessity for attending to this fact in pistol-shot wounds of the chest; Greater frequency of inflammation in the right lung than in the left; Treatment of pleuritis and pneumonia; Bleeding; Practice of Dr. Gregory and Dr. Rutherford of Edinburgh; Aphorism of Laennec; Illusory character of the pulse as a guide for bleeding; Opinion of Laennec; Mr. Guthrie's early experience of the efficacy of bleeding in pleuro-pneumonia, at Berry Head, and in British North America; Directions for bleeding; Opinions of the French physicians respecting bleeding in pleuritis and pneumonia; Application of leeches; Cupping; Internal use of tartar-emetic in pneumonia; Tolerance of tartar-emetic in large doses; When of doubtful utility; Use of mercury in serous inflammations; Mode of exhibiting mercury in large and small doses; Comparative value of mercury and tartar-emetic; Blisters; Diet; Critical terminations of pneumonia.*

The changes which take place in the structure of the lung in pneumonia, were first accurately described by Laennec; they have been not less ably investigated by Andral, and commented upon by a host of others of all nations, who have followed in their footsteps with equal interest and not inferior ability. They are three in number. I. Engorgement, the *engouement* of the French. II. The hepatisation of Laennec, the red softening of Andral. III. The purulent infiltration of both. The formation of an abscess or vomica, and the occurrence of gangrene, are so comparatively rare in idiopathic pneumonia, that they may be omitted without inconvenience, as well as chronic disorders of long continuance or malignant complaints, in the views about to be taken of disease from injury.

I. In engorgement, or the first stage of inflammatory obstruction, the lung has assumed externally a livid red or violet colour. It is heavier and firmer than in its healthy state, and the natural feeling of crepitation, although greatly diminished, is not extinct. The lung retains the impression of the finger, and pits on pressure as if it contained a liquid, although air bubbles can yet be distinguished in it, and its cellular or spongy texture is still to be observed. On cutting into it a quantity of sanguineous or turbid fluid flows from it mingled with numerous minute air bubbles. In some places the colour of the incised surface is darker, and more compact, shewing that some progress has been made towards the stage of hepatisation. It neverthercless tears with greater facility than in a healthy state, although this is in some measure common to it, when loaded with blood by gravitation without active inflammation. Dr. Henderson, in the *Monthly Journal of Medical Science*, for Sept. 1841, was led from the use of the microscope to differ on this point, and to suppose that inflammation could be always distinguished from congestion, as, in inflammation of the air-vesicles, a careful examination of the fluid pressed out of the small bronchial tubes, after washing the cut surface, always shewed minute white specks, which under the microscope appeared to be globular, if not granular.

The second stage is the red softening of Andral, the hepatisation of Laennec; the latter term being in most common use, from the lung assuming somewhat the appearance of the liver in solidity and weight. It does not crepitate, no air bubbles pass out of it, but a thick bloody fluid exudes on pressure, and it sinks for the most part in water. The colour is somewhat less red or violet than in the first stage, and lighter and more varied in colour when cut into; the openings of the larger vessels and of the bronchi, when cut across are observed as white specks, the interlobular tissue is thicker and more marked in lines running in different directions, whilst many little granular points can be discovered, especially with a glass, apparently of a more solid material than the surrounding parts. These granular bodies were supposed by Andral and Laennec to be the air cells converted into solid grains, by the thickening of their walls, and by the obliteration of their cavities by a concrete fluid. Messrs. Hourman and Dechambre, and Dr. Williams, differ in opinion on this point.

The word solidity, or solidification, is not quite applicable to the lung under any circumstances, although it is sufficiently explanatory in contradistinction to the naturally pervious and crepitating state of that organ. Andral is disposed to believe, and Dr. Stokes to agree in the opinion, that hepatisation arises from an excessive congestion of blood, and not from any deposition of lymph. It is not easy, however, to understand, in the present state of our knowledge, how acute inflammation can go on in that part alone for three or more days without secretion and deposition being added to congestion, although the validity or invalidity of the opinion may not be matter of importance. That hepatisation, or impermeability to air, may take place in the typhoid pneumonia in twenty-four hours, and that it as suddenly seems to be removed, is hardly conclusive, as it shews merely that a thoroughly well-loaded lung ceases to be permeable to air, until a part of the load shall have been displaced.

When the lung, inflamed to the second stage or that of hepatisation, is about to be restored to a state of health, a slight crepitation or crackling begins again to be heard at the end of each inspiration, and as this increases (the rhonchus crepitans redux of Laennec) the bronchial respiration and voice gradually, or after a time, diminish, until they entirely disappear, whilst a mucous rale or rattle commences, the index of that free expectoration by which pneumonia usually terminates.

Dr. Macdonnell, in a paper published in the *Dublin Journal of Medical Science*, for January, 1845, expresses his doubts, however, of the dry crepitus, heard in pneumonia, being pathognomonic of inflammation, unless accompanied by other symptoms, such as dullness, difficulty of breathing, cough, rust-coloured expectoration, flushed countenance, anxiety, quick pulse, and other febrile symptoms, and he has been led to think so from finding such crepitation, or crackling occur on a forced respiration, without any other sign of disease accompanying it, after pleuritic effusion, when the patient was fast recovering, in which case he did not consider it to be a sign of inflammation returning, but of the air-cells of the part becoming permeable to air, although still partly infiltrated by serum, the result of the congestion which had previously taken place, and which crackling passed away without any particular treatment.

The third stage of morbid change is called purulent infiltration. The lung is of a lighter colour from the intermixture of a new matter in its substance, although in the first degree it preserves its firmness and granular structure. The new secretion is of an opaque, straw, or yellow colour, and puriform in its nature. This is discoverable more particularly in spots, but as the disease proceeds, it pervades the whole substance of the lung, which becomes softer and more moist, and is easily broken down by the fingers, the granular structure having disappeared. It is more or less a purulent sort of sponge, in which all of the lung that can be perceived under a strong light may be resolved into small blood-vessels, bronchial tubes and interlobular septa.

Dr. Henderson thinks that the microscope shews that the grey hepatisation or the third stage is not so much a stage of true suppuration, as of infiltration with mucus into cells, which have not yet advanced to that purulent condition which they are supposed to attain in the ultimate stage of their mutation, if the inflammation should continue unabated, or the patient live so long.

These three degrees or stages of inflammation may be met with in the same lung, for the most part gradually intermingling one with the other. The lower part of the lung being ordinarily first affected, is usually the seat of the purulent infiltration of the third stage, whilst in the tubercular affection which ends in phthisis, the disease commonly begins in the upper part.

Resolution or recovery from even this, the last of the morbid changes which have been observed, may take place, although it is less likely to do so after idiopathic than traumatic inflammation, in which the lung was previously healthy, and the constitution unimpaired.

Laennec thought that when a considerable effusion took place in pleuro-pneumonia, filling the posterior part of the chest, when the patient lay on his back, it nevertheless diffused itself over the whole surface of the lung. This has been disputed, particularly by Piorry, Reynaud, and others, and I am satisfied from dissection in cases of wounds, that the fore-part of the lung may be applied to the anterior part and sides of the ribs whilst a serous effusion fills the hollow behind, the respiratory murmur being distinctly heard above it. It occurred in the well-known case of Mr. Drummond, killed by M'Naughten, and it is a most important fact to ascertain, particularly in pistol-wounds of the chest, in which the opening is not sufficiently large to allow any fluid effused to run out. Laennec however admits that the respiratory murmur can always be heard near the vertebral column, opposite the root of the lung, even when the lungs are so compressed by the effused fluid as to be scarcely discoverable, and that it may be heard below the clavicle when the quantity thrown out is moderate. Whenever it can be heard in these places only, it may be supposed that the quantity effused is considerable; although Laennec believed, that the substance of the lung became impervious to air whenever it was compressed to the extent of one-fourth: but that after a time, the lung becoming habituated to this pressure re-admitted the air, and that respiration could be distinguished in places without any diminution of the effusion. Great and sudden effusions usually take place in elderly persons, or in adults of a bad habit and weakly constitution, and whenever they do occur, the defective respiration, which may be even null, is not accompanied by the crepitating *râle*, which marks under auscultation the first stage of pneumonia. By percussion the resonance is always dull.

With respect to the greater frequency of pneumonia on one side than the other, Lombard has stated in the *Archives Generales de Médécine* for 1831, that of nine hundred and sixty eight patients treated with pneumonia, by Messrs. Chomel, Andral, and himself, one hundred and ninety five had disease in both lungs, two hundred and sixty in the left, and four hundred and thirteen in the right, so that for four hundred and fifty-five attacks on the left, there are six hundred and seventy three on the right, which he attributes to the great size of the branch of the pulmonary artery sent to the right lung; he considered that pneumonia occurred more frequently in infancy and in old age, than in the middle period of life.

In the treatment of pleuritis and pneumonia, the first and most essential remedy is bleeding, which should be resorted to in every case, whenever the febrile excitement is really inflammatory. All old people under such circumstances, unless in a cachectic state, bear at least one bleeding well; they often bear more. I know no fact more important, and none which my experience has so amply confirmed, in opposition to the opinions commonly entertained on this subject. In young people, the bleeding should be repeated until the desired object is effected; and the quantity required to be drawn in inflammations, particularly after injuries, is often very great. It is almost a question, in some cases, whether the patient shall be allowed to die of the disease, or from loss of blood. Dr. Watson reports in his lectures "that the late Dr. Gregory, of Edinburgh, who had northern constitutions to deal with, was in the habit of saying, that provided he was called early to a case of pneumonia, he would be contented to dispense with all other aids than those of a lancet and water-gruel." It was said that "he used to bleed to the verge of convulsions, but that his colleague, Dr. Rutherford, seldom went beyond three bleedings, and generally accomplished his object by two, judiciously timed and regulated. His patients recovered quickly: Dr. Gregory's very slowly." I have some doubts of the accuracy of this statement. Dr. Gregory perhaps saved the lives of persons who would have died under Dr. Rutherford; and their recovery was of course effected slowly.. If it were otherwise, all that can be said is, that Dr. Gregory was a bad practitioner, who repeated his bleedings without paying attention to the presence, or absence, of those symptoms which rendered them necessary, or their repetition unadvisable. The aphorism of Laennec, on this point, should never be forgotten. "Convalescence is rapid in proportion as the inflammation is of a small extent, and has been early subdued." As the first stage of pneumonia only lasts from twelve hours to three days before it passes into the second, and the second from one day to three before matter begins to be deposited, no time is to be lost to prevent these evils taking place, if the patient is to be saved, without incurring a risk, from which few escape with health, even if life be ultimately saved. Bleeding in inflammation of the pleura, in young and healthy persons, should therefore be effected in a very determined manner, and with an unsparing hand, until an impression is made on the system—until the pain and the difficulty of breathing are removed—until the patient can draw a full breath, or faints; and the operation should be repeated, from time to time, every three or four hours, according to the intensity of the recurrence, or the persistence of the essential symptoms. The pulse does not often indicate the extent or severity of the inflammation, although it often expresses the amount of constitutional irritability of the person. It is sometimes exceedingly illusory as a guide, and is never to be depended upon in the earlier stages of disease, when accompanied by pain and great oppression of breathing. In the latter stages, the dicta of Laennec should be strictly attended to. He says:—"Whenever the pulsations of the heart are proportionally much stronger than those of the arteries, we may bleed without fear, and with the certainty of finding the pulse rise; but if the heart and pulse are both weak, the abstraction of blood will almost always occasion complete prostration of strength;" a remark of the greatest practical value, and one which should never be forgotten. In healthy young persons, in the acute stages of disease, a large and successful blood-letting is usually followed by an augmentation of the size of the pulse, and oftentimes by a diminution of its frequency.

In the year 1801, I found myself, not seventeen years of age, in charge of a regiment of infantry, on the top of the Berry Head, the outermost point of Torbay. The men were soon attacked by pneumonia. I had been taught the practice of physic in London—had followed, among other avocations, the late Drs. Rowley and Hooper for three years, and, in consonance with their views, bled my patients three and four times in the first forty-eight hours. I first drew sixteen ounces, then fourteen, then twelve, then abstracted, as the complaint continued, eight ounces; gave tartar emetic, so as to keep up nausea; then calomel, antimony, and opium, and lost my patients. True also to the precepts I had learned, I examined the bodies of them all, and found that they had lived to what is now called the third stage of pneumonia, combined in almost all with pleuritis, with effusion, and the formation of false membranes. The disease was essentially a pleuro-pneumonia, varying in different degrees, as the pleura or the lungs were principally affected. Discomfited by my failures, I re-considered every case, and saw that however systematically I had acted, the disease had not been arrested in any one of them. In fact enough had not been done. Recollecting what I had been told of northern constitutions, and of country practice, I determined that in future, they should die of the bleeding, and not from excess of inflammation. I then took away on each occasion, as much more blood; my sixteen ounces became from twenty to thirty. It would not do. I arrested the rapid course of the disease, but did not effectively subdue it. It was evident that to succeed, I must place no limit to the abstraction of blood in the first instance, but the decided incapability of bearing its further loss. The men were all young, and in high health; the winds were sharp and cold at night; and smuggled gin was cheap, strong, and plentiful. I therefore bled every man when he came into the hospital, until he fainted, and repeated it every four hours, or even oftener, as long as pain or difficulty of breathing remained; and they sooner or later, all recovered. Every one, however, had taken alarm. Some said I had killed my patients with physic—others, that I was now bleeding them to death; and the officer commanding had determined on writing to London to ask for a better or more experienced doctor, as I afterwards learned—if another death was reported on the following morning. It did not occur, and I soon became in good repute.*

The young doctor, as I was called, (the two Lieutenant-Colonels—one the late Lord Frederick Montagu, the other the present Lord Strafford, were only 23 and 22), instead of being dismissed, on account of his youth, was declared to be a very useful person--a reputation I carried with me to Portugal in 1808, and which early placed me in that position in the Peninsula which enabled me to avail myself of those opportunities which have led to my now addressing you. The lesson learned at Berry Head was not forgotten during the five subsequent years passed in British North America. The men were as healthy, the winds were sharper and colder, the vicissitudes of all kinds greater. Rum was even cheaper, newer, and stronger than the gin of Torbay. The local inflammations were often as severe, whether of the pleura, or of the lungs, and by no means less so in cases of inflammation of the bowels. One of the first of these I had to treat was in a grenadier some six feet three inches high, broad and well-framed in proportion; he owned he had drank a gallon of rum during the afternoon, and very narrowly escaped, even with the loss of nearly as much of his blood, abstracted in a few hours. His first bleeding was into the wash-hand basin, and until he fainted, lying on his back, and the bleedings were repeated as soon as he again began to feel pain. I said to him, you will probably die, but it shall not be from rum or inflammation; and whenever he felt pain he used to put his arm out of bed to have the vein reopened, for Jack Martin was a very gallant fellow. I have given this not as an ordinary but as an extreme case, to be borne in mind under circumstances somewhat similar, and particularly after injuries. In common cases of pleuritis and pneumonia in *healthy* persons, and particularly in pleuritis, it is now usual in this country to abstract blood, not by definite quantities, but until the pain and the difficulty of breathing are relieved, or fainting is about to take place. The patient should be raised in bed, the opening in the vein should be large, the flow of blood free. The quantity will vary from sixteen ounces to three times that amount in different people; but the important point is to repeat it as soon as the pain or the difficulty in breathing returns. It rarely happens that one bleeding, to whatever extent it may be carried will suffice to remove the symptoms, and recurrence must be had to this remedy as often as the pain and oppression require it, and the action of the heart will bear it, especially during the first two or three days. It will often be necessary to have recourse to it in smaller quantities for the next four or six days; and again in a less quantity on any return of the inflammatory symptoms. Where the patient is apt to faint, he should be bled in the recumbent position, and as it is necessary at first to take away a sufficient quantity of blood to relieve the loaded vessels, great care should be taken by arresting the flow of blood for a time, by giving stimulants, by admitting fresh air, and sprinkling with cold water, to prevent syncope, which is sometimes dangerous in elderly persons, who may be subject to, and who are not readily recovered from it. In the second stage of the complaint, profuse and repeated bleedings do not answer so well; they do not remove the evil which has occurred, although they may prevent its increase. Blood should then be drawn in such quantity only as will relieve the action of the heart, restless under its efforts to propel the blood through a hepatised lung. The quickness of pulse, the cough, the difficulty of breathing, must now be aided and relieved by other means; for although the pulse is not a certain indication, on which dependance can be placed in the early stage of this complaint, the breathing generally is; and as long as the respiration is oppressed, blood should be abstracted, until it becomes manifest that the effect has been to quicken the pulse, whilst it materially diminishes its power.

On the subject of bleeding, there is a marked difference among French physicians. Whilst Laennec and Andral advocate its repeated use, confining the quantity to four or five cups, of four ounces each, twice a day, Louis[*] is less favourable to its employment. He considers its influence to be much less than is commonly supposed; that it will not cut short a pneumonia during the first days of the disease; and that those who are bled in the first four days of the disease, are only cured four or five days sooner than those who are bled at a later period:—conclusions which, however correct they may be in the class of patients he had to treat, will certainly lead, if relied upon in cases of wounds of the lung, to the destruction of the individual. The opinions of Louis, supported as they have been by Trousseau, have not maintained their ground in France. They have been stoutly met by Bouillaud, by Jules Pelletan, and others, who acknowledge the influence of blood-letting not only in cutting short but even in curing this disease. Bouillaud, whose authority is great in France, gives the following as an example of his mode of proceeding in a moderately severe case. 1st day—Morning sixteen ounces, evening twelve ounces. In the interval twelve ounces to be drawn locally by cupping or leeches. 2d day—V. S. ad ℥xvj.; local bleeding if pain continues, by leeches or cupping. 3d day—If disease permit, another bleeding, although it is usually cut short on this day. 4th day—If the disease should attain to the second stage, another venesection may be resorted to, but it is in general best to abstain from it, and apply a blister. As a general rule, however, the abstraction of blood should not be refrained from until the febrile action is removed or nearly so, until the dyspnea and the pain have nearly disappeared, and this rule admits of very few exceptions. On the whole, four or five pounds of blood may be drawn in the case supposed above."

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* Dupont says that Louis, the brightest star of the Royal Academy of Surgery, of Paris, in 1743, had so distinguished himself with the army of the Rhine, as to have merited, and obtained, the rank of a Surgeon-Major at twenty years of age. He distanced me by a year on this point, as I fear he did by more than that on most others. Cheselden publicly taught anatomy at twenty-three; but unhappily, the brains of men have become so thick since the days of Cheselden and of Louis, that they are now found only fit to have their competency enquired into at the age of twenty-five or six. Alexander von Humboldt says in his Kosmos—"the quiet which we (the earth) enjoy is only apparent, the tremblings which still shake the surface in every latitude, and in every species of rock—the progressive elevation of Sweden and the appearance of new islands of eruption—are far from giving us reason to suppose that our planet has reached a period of final repose." It is to be hoped that the changes which may take place in Physic and Surgery, as well as in our globe, during the next century, may not extend the period of study from five-and-twenty years to thirty, unless another ten years can also be added to the usual term of human existence.

A cupped and buffy state of the blood, together with a firm coagulum, is a satisfactory proof of the propriety of bleeding in this stage of the disease, but after the effect of mercury on the system has been produced, it cannot be depended upon with the same degree of certainty as a sign of power. When the propriety of further venesection is doubtful, the greatest advantage may be obtained from the use of leeches and from cupping, particularly in cases of injury of the chest. Leeches may be applied by tens and twenties at a time; and when they have ceased to bleed into a warm bread and water or evaporating poultice, they may be replaced by as many more, until the pain and the oppression have been removed. Cupping is always to be had recourse to when leeches cannot be obtained, and when well done, it is frequently to be preferred; cupping to sixteen ounces will usually be found equivalent to forty or more leeches. Both these means often relieve to a greater extent, with less general depression, than a smaller quantity of blood taken from the arm, and, are therefore at such times more advisable. When blood cannot be obtained from the veins, the arteries must furnish it, and I have often opened both temporal arteries with the best effect, when blood could not be obtained from the arm, or readily from the external jugular vein.

The effects of bleeding were of old found to be different under different circumstances and in different climates. Asclepiades remarks that whilst phlebotomy was fatal at Rome and at Athens, it was beneficial in the Hellespont. Nevertheless, at a much later period, Baglivi says, "In Romano, phlebotomia est princeps remedium in pleuritide."

The internal remedy first to be administered, and most to be depended upon in the first stage of pneumonia is tartar emetic. Dr. Rowley always ordered, in my early days of studentship, four grains to be dissolved in sixteen ounces of water; two ounces to be taken every two, four, or six hours, according to the urgency of the complaint, and the effects of the remedy in causing nausea, and I am not aware that I ever treated an inflammation of the lungs without it. The merit of introducing this remedy, however, into practice has been given to Dr. Marryatt of Bristol, who published in 1790. Rasori of Genoa was the first who endeavoured to explain its action when given in a larger quantity, and certainly established it in general practice on the continent. Laennec, Andral, and all succeeding writers have borne testimony to its utility. Laennec gave a grain of tartarised antimony every two hours until the patient had taken six grains, when it was omitted for seven or eight hours if the symptoms were not urgent. If however the symptoms of disease were distressing, he did not intermit its use, but gradually increased the dose to two grains and a half, until not only the intensity of the symptoms, but of the stethoscopic signs had been greatly subdued.

As tartar emetic usually gives rise to vomiting, then purging, and possibly sweating, it should not be omitted, because such effects are produced in the first instance. After a few, perhaps three or four doses, the vomiting usually ceases, the stomach tolerates its introduction, and its gradual increase from six to nine, twelve, twenty, or more grains a day, is often borne not only with impunity, but with great advantage. Vomiting and purging, although often followed by the most beneficial results are not desirable, as the effects of tartar emetic are more rapid and more beneficial, when they give rise to no particular evacuations beyond that of general perspiration. The most valuable remark of Laennec's[*] on its use, is, "that by bleeding we almost always obtain a diminution of the fever, of the oppression, and of the bloody expectoration, so as to lead the patient and the attendants to believe that recovery is about to take place; after a few hours, however, the unfavourable symptoms return with fresh vigour; and the same scene is renewed often five or six times after as many venesections. On the other hand I can state that I have never witnessed these renewed attacks under the use of tartar emetic." He further says that the same favourable results do not occur from its use in pleurisy, or in inflammation of serous membranes, as in pneumonia, and suggests its administration in a slightly aromatic infusion, such as that of the orange leaf, or sweetened emulsion, to render it agreeable to the stomach, or in conjunction with a little syrup of poppies, or a few drops of tincture of opium when it purges. Dr. Williams recommends a drop of hydrocyanic acid with each dose, for the same purpose.

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[*] Louis. Archives Generales de Médécine livre xlvii.

[*] See Laennec, 4th edition, translated by Dr. Forbes, and the valuable note of the translator, vol. 1, page 244.

It is a remedy of doubtful utility when the disease or pneumonia is from the first combined with irritation of the mucous membrane of the bowels, or with general tenderness of the epigastrium, or whole of the abdomen. It is not to be depended upon alone for the cure of pneumonia, not even when combined with small bleedings; and the dicta and the facts of Laennec have been doubted on this point by his brethren. M. Lecoulteulx, aide de clinique in the Hospital La Charité, who followed for twenty years the practice of Corvisart Leroux, makes the following remarks on the mortality which took place under the treatment of Laennec. "I was particularly struck by the very great difference in the mortality of the pneumonias which were treated by large bleedings, when compared with that of those which were treated by tartar emetic and small bleedings. Incomparably fewer deaths occurred among the former, and the convalescence was much quicker, taking place about the ninth instead of from the fifteenth to the twentieth day." It is probable that the practice of Drs. Gregory and Rutherford, formerly alluded to, might have been better understood, if reference had been had to the mortality as well as to the recovery of any given number of cases indifferently chosen. The sovereign efficacy attributed to tartar emetic by Laennec and Andral has also been doubted by Pelletan, who commenting on the practice of Bouillaud at the Charité, and which the latter admits in 1835, says: "I have not seen this medicine more efficacious when tolerated by the stomach than when it vomited or purged violently, neither have I seen it exert any decidedly advantageous influence on inflammation of the lung, bleeding being after all the really heroic means of combating it. Nevertheless its great utility in lowering inflammatory action cannot be doubted."

Mercury is a remedy of the greatest importance in serous inflammations such as pleuritis, although of less value than tartar emetic in the first stage of pneumonia, than which it would appear to be more efficient in the latter period of the stages of hepatisation and infiltration, though some physicians agree with Laennec, and place entire confidence on its efficacy in all. It is of most value when combined with opium, in which form I have always used it with the greatest advantage. Upon the precise importance or value of each of these remedies there is a difference of opinion, some supposing that the opium merely prevents the irregular action of the mercury, others, as far back as 1801, believing that the opium has a distinct curative effect, being capable when given in large doses of subduing inflammation, and more particularly of allaying pain, relieving the cough and irritation, and of procuring sleep, in which opinion I fully concur. Opium is highly advantageous in irritable and nervous persons, and will frequently relieve the nervous pain, the pleurodynia which remains after pleuritis, when nothing else succeeds. Calomel in large doses is usually preferred to all other forms, but a difference of opinion has here also occurred as to what is a large dose, whether two, three, four, six, ten, or twelve grains are large doses, and whether they should be given every one, two, three, six, or twelve hours. It has been attempted to reconcile this difference of opinion, by supposing that in sthenic or highly inflammatory cases in healthy persons, from three to six and even to twelve grains may be given twice or three times a day, with better effect than smaller ones more frequently repeated.

If after bleeding the pain is considerable, whilst the pulse is weakened, twice that quantity or even more may be administered with advantage. Mr. Boyle, a surgeon of the Navy, was the first to recommend a dose of twenty grains at night as a sedative. In cases less sthenic or complicated with gastric derangement, the fever assuming more of a general than of an inflammatory character, the excretions being vitiated, the skin dry and hot, and the tongue loaded, from gr. iss. to g. iij. of calomel combined with three grains of Dover's powder may be advantageously given every second or third hour. All however agree that the great object is to affect the gums as quickly as possible. This unfortunately is not effected in some cases by any of the quantities given until after a considerable lapse of time, whilst in others it is accomplished by less than half a dozen grains of the remedy. I am not disposed to believe that twenty-four or forty grains given in two or four doses in twenty-four hours will affect the mouth more rapidly than three grains every two hours for the same time, neither am I aware that it is less liable to cause irritation; whilst the third or half a grain of opium given every two hours seems to keep up the effect of that remedy with great advantage. I do not think it signifies much which method is adopted in strong and healthy persons, although the more frequent doses are most satisfactory to all parties when the patient is weak and irritable, whilst the large and less frequent doses often excite great apprehension. It is argued by Drs. Graves and Hudson of Dublin, that calomel in large doses never causes the dysentery nor the severe ptyalism produced by smaller doses; that it acts more quickly, and that after giving twenty grains and repeating it in six hours, any other medicines may be given without interfering with it, although the strictest attention must be paid to diet, generally confining it to very small sups of warm whey. I regret to say I cannot concur in this opinion without considerable reservation, having lately given to the students at the Ophthalmic Hospital the opportunity of seeing that very serious derangements do follow the exhibition of the large as well as of the small doses, inasmuch as it is impossible to know beforehand what quantity will cause a severe salivation or diarrhœa which it may be difficult to arrest.

I have rubbed mercurial ointment all over the body several times a day in cases of tetanus, without producing any effect whilst the patient lived; this mode of proceeding can only be auxiliary; although the good effect of mercury is often visible before the gums become sore,an object which should always be attained if any symptoms of disease remain.

It may be concluded, that of the two heroic internal remedies, tartar emetic and calomel, recommended for the cure of inflammation of the chest, tartar emetic, or tartarized antimony, the antimonii potassio-tartras of the Pharmacopœia of London, is the more appropriate for inflammation of the lungs or pneumonia, provided it is not accompanied by symptoms of gastric inflammation, when its use should be, for a time, superseded by leeches, if necessary, to the epigastrium, and saline aperients, lest the irritation, vomiting, and purging should increase the evil. But care must be taken that one inflammation shall not be allowed to increase, whilst attention is principally paid to the other, and symptoms of irritation, the *gastro-enterite* of Broussais and the French physicians, are not to be mistaken for gastritis. Mercury, in the form of calomel, or chloride of mercury, is more to be depended upon in inflammation of the serous membrane of the pleura, over which, as well as over inflammation of similar membranes in other parts of the body, it exercises a remarkable influence.

Blisters are never useful during the continuance of acute inflammation of the chest, although their use is indicated when the patient is much exhausted, the pulse weak, and the breathing continues difficult; or in cases in which the disease proceeds slowly, or is becoming chronic, when they often do much good. Continental practitioners apply them as derivatives to distant parts, a practice not usually followed in this country in any stage of acute inflammation of the chest. The same may be said of dry cupping, mustard poultices, and other cutaneous rubefacients, which often do much good in the commencement and termination of slight attacks, or of their supervention on chronic disease, as after injuries.

In the acute stages simple drinks only should be allowed. As soon as the inflammatory action has subsided, the lightest farinaceous nourishment, gradually augmented by the addition of broths, jellies, eggs, fish, and lastly animal food, should be substituted. The temperature of the room ought to be moderate and equal.

Inflammation of the lungs frequently terminates by the deposition of a white or lateritious sediment in the urine, which is considered a critical evacuation, not, however, to be relied upon, unless accompanied by a remission of the important symptoms. After this urinary deposition, a moderate diarrhœa and profuse perspiration are the most favourable signs of a crisis.

## LECTURE IV.

*Typhoid Pneumonia—Symptoms and Treatment; Dr. Hunter and Dr. Stokes on Typhoid Pneumonia; Typhoid Pleuritis; occurrence of Pleuro-pneumonia after Amputations; Mr. Guthrie's opinion that it depends on Inflammation of the Veins, and Absorption of Purulent Matter: latent or chronic Pleurisy; Empyema; Hydro-thorax; causes of Empyema; Symptoms; Pathological Condition of the Chest after the Cure of Empyema; Dr. A. T. Thomson's Case; Results of Percussion and Auscultation; Treatment.*

Inflammation of the chest has been hitherto considered as accompanied by inflammatory fever as an essential character, but this is by no means always the case. In large cities, and amongst troops, after hard service, in which they have been subjected to much privation, and in certain epidemics, the accompanying fever often partakes of a different character, becomes infinitely more dangerous, and requires a different mode of treatment. These modifications of disease I have known from my earliest years, in London, in North America, in Portugal, and in Spain, in the two last of which countries they are very fatal. They appear to prevail much in Dublin, and Drs. Stokes and Hudson have given the best account of them with which I am acquainted, under the name of typhoid pneumonia, constituting a disease formed of a local inflammation with general symptoms of a low asthenic type of fever, combined with those of marked derangement of the stomach, intestines, or liver, as shown by a dry black, or red black, or brown tongue, offensive breath, diarrhœa, vomiting of a dark-coloured or greenish fluid, watery or sanious expectoration, great thirst, headache, a feeble and quick pulse, low delirium, and great prostration of strength. It was marked, on the banks of the Guadiana, by the discharge of lumbrici by the mouth and by the anus. Whenever I have seen this disease it has always appeared to arise from peculiar circumstances, and to disappear when they ceased to exist; such as great privations and exposure to cold and fatigue, the use of ardent spirits without sufficient food, bad air, or other depressing causes. It is sometimes under such circumstances epidemic. In these cases, as far as my recollection of them permits, as I have not seen them lately, I should say the pneumonic affections were always secondary or consequent on the idiopathic fever. The general fever is typhoid, the local inflammation latent, and the symptoms of it masked. It may be complicated with a similar affection of the stomach and intestines; it may occur in cases of erysipelas, after diffuse inflammation of the cellular membrane, after wounds or injuries attended with large secretions of purulent matter, after phlebitis, and with other complaints. Dr. Stokes especially draws attention to it in connection with delirium tremens from excess of stimulants. Whilst the symptoms of low fever are general and well marked, those of the latent affection of the lung are not so prominent or even observable. The patient complains but little, and sometimes not at all of his chest, until attention is drawn to it by a slight cough, and difficulty of respiration, attended by a character of countenance which usually indicates embarrassment in the functions of the lung. It may be brought on by a common non-penetrating injury of the chest.

In typhoid pneumonia general bleeding, if admissible, is to be had recourse to with extreme caution, even in young and robust persons. Local depletion is oftentimes useful, and perhaps ought alone to be relied upon. The great dependance is on calomel and opium, and after such local depletion as may be thought advisable, counter-irritation by blistering, and the administration of stimulants, such as camphor, ammonia, and wine, in small and repeated quantities. Mild aperients only should be employed, and anodyne injections are frequently useful. Whilst auscultation has thrown a clear and steady light on the nature of the mischief which is going on, it has added little or nothing dissimilar to the practice pursued some forty years ago. The nature of the hepatisation or solidification which takes place in the lung in typhoid pneumonia has given rise to some difference of opinion among morbid anatomists, who incline to believe, from the rapidity with which it takes place, and is sometimes as quickly removed, that it depends more on passive congestion, and on a typhoid alteration of the state of the blood, than on an altered action in the vessels of the part. This opinion is maintained by Dr. Hudson in his very able paper on typhoid pneumonia, in the seventh volume of the Dublin Journal for 1835; but it does not seem to me to be supported by his dissections, unless it be generally admitted that grey hepatisation, and the third stage of disease of the lungs in pneumonia, mean simply congestion. He concludes his paper by the following good practical remarks:—"The epidemic constitution of the disease, and its pathological condition (connected as both seem to be with an altered state of the blood), often combine to render these cases prone to run into gangrene; and that they are otherwise tedious and intractable, and generally require the early and liberal use of stimulants, as well as the prompt and cautious employment of the most active means for subduing inflammation; and I think the necessity for the former may be stated to be in proportion to the degree of prostration, and the extent of passive congestion as indicated by dulness on percussion, and nullity of all respiratory phenomena."

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* Stokes, Wm. A Treatise on the Diagnosis and Treatment of Diseases of the Chest. Part I. p. 338. 1837. Dublin.

† Hudson, Alfred. Observations on Typhoid Pneumonia, vol. vii. for 1835, p. 372, of Dublin Journal of Medical and Chemical Science.

Dr. Stokes, in his excellent work on Diseases of the Chest, page 342, says:—"The terminations of typhoid pneumonia are various. It may rapidly produce a fatal hepatisation; it may form a gangrenous abscess, or induce a chronic solidity of the lung, passing into the tubercular condition." His practical conclusions are extremely valuable, as this disease often prevails in Dublin. They are—1. That general bloodletting is to be used with extreme caution. 2. That the mercurial is in general to be substituted for the antimonial treatment. 3. That counter-irritation may be employed at an earlier period than in simple pneumonia. 4. That the vital powers are to be carefully supported. 5. That as gastro-intestinal disease frequently complicates the pneumonia, close attention must be paid to the abdominal viscera. 6. That stimulants are to be used with greater boldness and at an earlier period.

When the patient survives the imminence of danger in which he is placed by the attack of the disease, and the expectoration becomes copious, with great emaciation, quick pulse, and hectic fever, a slight infusion of senega with ammonia, or of cinchona, with a mild and well-regulated diet, and change of air and climate, answer best in aiding recovery.

A typhoid pleuritis is presumed to exist, as a distinct disease from typhoid pneumonia, although the analogy between them is admitted to be close; like it the disease is latent and oftener pointed out by the sinking of the powers of life, than by any new suffering. The signs of effusion may be discovered on auscultation, and the treatment is essentially similar, blistering and counter-irritants, being perhaps more useful, if time be granted for their application.

I was the first, I believe, to draw attention in my work on gunshot wounds, published in 1815, to the connexion which existed between the latent disease of the lung which may be called pleuro-pneumonia, somewhat resembling these complaints when of a typhoid character, and to its occurrence after the operations for amputation, for although affections of the liver and even lungs, following injuries of the head, had been observed by Morgagni, Valsalva, Quesnay, and others, they were always considered to be accidental circumstances. I have also related, or referred to cases of this disease, and of purulent deposits, in the third edition of that work and its appendix. It is evident that I then considered these inflammations of the lung, and purulent deposits in other parts of the body, to be dependent on the same cause, and I suspect they are both more intimately connected with inflammation of the veins, and the absorption of purulent matter, which may be deposited in the cellular texture of the body with impunity for a time, but which in the lung or pleura is followed by low inflammation, ending in death. The treatment, which, as far as I know, has been hitherto almost always unsuccessful, ought apparently to be conducted on the same principles as those which are adopted in typhoid pneumonia, or typhoid pleuritis, although the dissections I have made, or am acquainted with, authorise my saying, that these two complaints have been so combined, as to prove that in this particular disease they are not distinct affections. Mr. Rose drew attention to these depositions and affections of the lung, after injuries and operations, in a paper read before the Medico-Chirurgical Society in 1828, thirteen years after my first publication, and M. Marechal did the same thing in Paris, in the same year, both being one year after the publication of the third edition of my work on Gunshot Wounds, and without adding anything to the facts I had stated, or to our knowledge on the subject; and it is a matter of surprise to me, that Dr. Townsend, in his able article on Empyema, in the Cyclopædia of Practical Medicine, should have noticed the labours of Mr. Rose and our continental brethren, without referring to mine which preceded them by so long a period—a point of no consequence, further than it may as well be known that the science of medicine is indebted for this fact to my record of the practice of the peninsular war. Andral has been led to believe, that "during the period of profuse discharge, pus is taken into the circulation, and subsequently separated from the blood, as mercury when injected into a vein, is found to deposit its globules in different parts of the body." It is impossible to say, even if this opinion should be correct, what may be the cause which leads to its deposition in particular parts. I have supposed it to be from its giving rise to irritation in one that is weak, but that is not an explanation, although it may be the fact.

Pleurisy is said to be latent, or chronic, when a consequence of acute disease, insufficiently or incompletely treated, and not a primitive complaint. It is marked more by oppression of breathing than pain, and auscultation proves the nature of the complaint. It may exist for weeks, and months, and continue even for a year, wearing out the patient until he becomes hectic, and thoroughly emaciated, suffers from empyema, and dies perhaps by dropsical infiltration or by suffocation.

The cases which commonly fall under the care of the physician, which render an operation necessary, are those in which the acute inflammation was neglected in its first stages, or not met by means sufficiently energetic, or from some recurrence of the complaint.

*Empyema, from εν in, and πυον pus,*—a name given by the ancients to all abscesses formed in the cavities of the trunk,and by later authors to all collections of fluids in and to the operation for evacuating them from the cavity of the chest. Empyema is not a special disease, but the result of another; commonly of acute or chronic pleurisy, or of injuries of the chest, which give rise to inflammation, ending in suppuration. When it occurs from the effusion of a serous fluid, constituting a local dropsy, it is usually the result of disease of the heart, or of the great vessels, and is accompanied or preceded by symptoms indicating the existence of these complaints; in which case it is not likely to be benefited by any operation. The disease is then denominated hydro-thorax. The serous fluid is generally transparent, although more or less tinged with blood, when thrown out in persons who die within a few days after receiving a wound of the chest. It may, and does occasionally, contain in these cases, a large quantity of blood; but the early effusion of blood is not uncommon in very acute cases of pleuritis. It is usually more or less turbid when the result of ordinary inflammation, although the presence of albuminous or purulent matter is not constant. Whether colourless, transparent, turbid, or purulent, it remains free from fetor, unless gangrene has occurred internally, or some communication with the atmosphere has taken place, by an external opening.

Whilst the fluid remains transparent, the appearance of the pleura is little changed, but when it has become turbid in any great degree, or flocculent, or purulent, the pleura has lost its natural appearance. In its simplest character, when the fluid is puriform, and particularly if the inflammation has not been very active, it is covered with a layer of whitish inorganic sediment, which can be scraped off by the scalpel. This is sometimes quite red, as if loaded with blood, which had been deposited upon it. Whenever pleuritic symptoms continue beyond the ordinary period, of about three weeks, or, after a temporary abatement, are followed by those of effusion, which are not in turn removed, the occurrence of empyema may be suspected.

Empyema may form from a pulmonic abscess bursting, or a gangrenous spot being detached and falling into the cavity of the pleura. An abscess in the liver, or other parts, may also communicate with the pleura, and abscesses—formed from injury, or otherwise—in the wall of the chest may also give rise to it. It is usually, however, caused by acute inflammation, by penetrating injuries, or by the introduction of foreign substances. It must, however, be borne in mind that when it occurs from wounds, the external opening must have healed, or the complaint would be simply a wound in the chest, with discharge from the cavity of the side affected. A true surgical case of empyema, following an injury of the chest, in which the wound has healed, is not to be ascertained but by the same means as a medical case, arising entirely from internal causes, unless the cicatrix should indicate the presence of matter behind it.

The symptoms by which the termination of inflammation in effusion may be known, are dyspnœa or difficulty of breathing, which varies, being greatest when the effusion has taken place rapidly, less when it has been gradual, inability to lie on the unaffected or sound side, arising in all probability from the weight of the fluid, which supposition may be regarded as correct, from the circumstance of persons being able to lie on the unaffected side, after the operation has been performed and the fluid evacuated, although it should be replaced by air in consequence of the lung being unable to resume its natural position. In some instances a person has been known to lie on the unaffected side, and in other cases, persons have at last accustomed themselves to lie on either side, but they are exceptions to the general rule. When the effused fluid has filled one side of the chest, the affected side is evidently enlarged. It is permanently dilated, and this can be distinctly seen when the dilatation does not exceed half an inch, measuring by a tape from the spinous process of a vertebra behind to the centre of the sternum. The ribs are nearly if not quite immovable, and partially raised, offering a strong contrast to the active motion of the ribs of the other side. The intercostal spaces in these persons may be more or less filled up, and even protruded, rendering the whole surface smooth and soft. In some very severe cases the external parts become œdematous, so that the ribs cannot be felt, and this sign, although not always present, is certainly pathognomonic when it takes place at a late period of the disease. When the effusion is into the left side of the chest, the heart is frequently pushed over with the mediastinum to the right side, and its pulsation can be seen and felt to the right side of the sternum, or it may descend with the diaphragm into the epigastrium, changes which are not so extensive or remarkable when the effusion is into the right side, as the liver materially impedes the descent of the diaphragm, and the heart is already in the left side, in which it is sometimes raised rather than depressed. Dr. Stokes says, and Dr. Chambers confirms the assertion, if the hand be placed over the affected side, whilst the patient speaks with a tolerably loud voice, and a strong vibration is felt in the part, the case is not one of empyema; but this is as uncertain a sign and as little to be depended upon, as the dullness on percussion which sometimes takes place under the sternum in empyema. The cough and expectoration offer nothing peculiar, unless a communication exist between the lung and the cavity of the chest, when the expectoration in general becomes very fetid and disagreeable. The febrile symptoms depend on the activity of the previous disease, and the rapidity with which the effusion has taken place.

Broussais and Andral say that night-sweats never accompany the hectic fever of empyema, unless there be tubercles in the lungs or pleura—a remark which cannot be depended upon, although it cannot perhaps be disproved; the differences which may be observed between the hectic of phthisis and that of empyema, being according to the rapidity with which persons labouring under empyema are cut off, unless the disease becomes essentially chronic, when it may exist for months and years.

Two symptoms have been insisted upon by older authors as distinctive of effusion in the chest, which more modern ones are disposed to doubt. One is an œdematous swelling of the back, the other a protrusion of the intercostal spaces. A third may be added when the effused fluid is blood, which is that the œdematous swelling becomes ecchymosed, or red, or bruised looking, from the effusion of blood into the cellular membrane beneath the skin, over the whole space occupied by the blood within. That the first two symptoms do assuredly indicate the presence of pus cannot be doubted, and that the third is a sign that the effused fluid is blood has not been disproved, but it must be borne in mind that they are late not early symptoms, and the operation should not be delayed until they are present, if other signs should appear to demand its performance. The pulpy swelling was known and remarked upon by Morand a hundred years ago. Valentin, in his *Recherches Critiques sur la Chirurgie*, published in Paris, 1772, was the first to notice the ecchymosis of the side and back when the chest was full of blood, a sign which Larrey particularly insists upon, but which certainly does not appear so early as to be distinctive, when other symptoms exist which almost render it certain. The swelling does not, I apprehend, arise from transudation of matter through the pleura, but from irritation transmitted through it, as in any other deep-seated abscess. Dilatation of the chest is usually an early symptom, although a considerable effusion may exist without it, or with a slight elevation of the intercostal spaces. When the complaint is distinct, these spaces are elevated to a level with the ribs, so that the surface becomes perfectly smooth and equal. The protrusion of these spaces so that they become prominent is a very rare occurrence, although frequently alluded to. Effusion indeed of serous fluid to a considerable extent, so as to displace the heart, may take place without the intercostal spaces being elevated; which is only believed to occur when the intercostal muscles have become paralysed. When the matter is evacuated, the muscles recover their tone, and the intercostal spaces reappear.

It has been already stated that when one lung only is diseased, *puerile* respiration takes place in the other. The unaffected side of the chest is perhaps dilated, the lung distended, and the mediastinum yields to the impression.

In all cases of empyema, in which the lung is so bound down by adhesions that it cannot be expanded by the continued process of respiration, a cure can only be accomplished by an alteration of the form of the affected side of the chest, by which its cavity is diminished, and often nearly obliterated; this is an effort of nature. Larrey was the first to prove this distinctly, and I have had very many opportunities of confirming the fact in all stages of the disease, from its commencement to its cure, or the death of the sufferer. The pleura changes its character, becomes so thick as materially to diminish the cavity, the diaphragm ascends, the heart leans to that side in many instances, the spine curves, the ribs thicken and become flatter, and close in upon each other, abolishing the intercostal spaces. Dr. Wendelstadt, ten years after a fistulous opening had taken place in his chest, from purulent deposit, found that the cavity would still hold a quart of warm water. I have seen it hold as much, after one, two, three, and four years. In a case under the care of Dr. A.T. Thomson, the operation was performed on the left side on the 1st of December, 1837; fifty ounces of pus were evacuated; the wound continued to discharge. On the 14th of February 1841 he was attacked with acute bronchitis, and died on the 17th, three years and ten days after the operation for empyema had been performed. As this case is one of a late date, when attention had been fully drawn to the subject, the essential parts of the dissection-report are transcribed. Emaciation considerable; the left side greatly flattened; spine curved to right side; heart lying over the spine; sound lung weighed two pounds, four ounces, two drachms; left or affected lung only ten ounces seven drachms. The space at the bottom of left thoracic cavity contained twelve ounces of fœtid purulent matter, and a piece of carious rib an inch long and half an inch broad. Pleura coated with a false membrane, nearly half an inch thick, and of cartilaginous firmness; the free surface black; ribs nearly an inch and a half in thickness; left lung adherent behind through its whole length, and below to the diaphragm. This patient lived long enough to permit the almost total obliteration of the pleural cavity, but he could not have recovered, unless the piece of carious rib had been removed by an operation.

*Percussion* gives from the sound side a clear, nay a clearer and more hollow sound than usual, resembling that from an empty cask; whilst from the affected side it is as dull as the sound from a full one, when struck with an equal force. When the fluid is small in quantity, or confined in any one spot, the dulness is confined to that spot. But these are not usually cases, the consequence of surgical disease.

*Auscultation* shews that the ordinary sound of the breathing is null, although at the root of the lung behind, some little bronchial respiration may be heard, and even some slight mucous rhonchus from the same spot; but these niceties of auscultation will never be sufficient to obscure the estimate made from the other symptoms. When the lung happens to adhere to the wall of the chest, some difficulty may arise temporarily, but not when the disease is otherwise well marked.

*Treatment.*—As long as the febrile symptoms, consequent on the inflammation, continue to any extent, medicines will be of little avail, and counter-irritants should be avoided. When they have subsided, purgatives and diaphoretics may be tried, in combination with tonics, and a light but good nourishing diet. Blisters applied frequently upon a large surface often do good; and Baron Larrey preconizes the use of moxas, which are not probably as useful, although they may assist in the intervals of the application of blisters, in chronic cases. When these means fail, the operation must be resorted to.

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The following extracts from a case reported by Dr. C. R. Golding, in the *Lancet*, for January 22, 1848, should be transferred to page 7, in a future edition;—

Case II.—A youth, aged eighteen, in February, 1846, struck the right side of the chest in falling from a chaise, and a few days after was attacked with pain in the part struck, with urgent dyspnœa, and fever. Cough, expectoration, and an obtuse pain in the right mammary region, increased by pressure and forced inspiration, soon ensued. He was admitted into the Charing-cross Hospital, in April under Dr. Shearman. He stated, that for five weeks from the supervention of the cough, the expectoration was scanty, the pain and dyspnœa not urgent; but just before his admission all the symptoms increased, still, however, referrible to the right side. The cough became urgent; the expectoration, profuse, and at first rusty, soon changed to a dark greenish hue, was very fœtid, voided in masses, and tinged with blood. The pain was of a dull dragging character, but soon ceased. This absence from pain (five days from the accession of the pneumonia, and two days before admission into the hospital) was consentaneous with the change in the sputa, from rusty pneumonic expectoration to that of sphacelated lung.

He was in the hospital eight days, presenting the following symptoms:—Cough urgent; expectoration copious, though dyspnœa and thoracic pain were absent; the sputa purulent, and containing portions of slough; it varied in tint from a greenish-yellow to a mahogany-brown, and was most fœtid, as was also the breath; great constitutional derangement; hectic; turbid urine; tongue dry and red; no cerebral symptoms, nor dropsy.

He left the hospital materially relieved, and became an out-patient, paying every attention to his diet and regimen. About the middle of September, the cough and expectoration increased; the latter again became dark and fœtid; the strength was prostrated, and several attacks of hæmoptysis occurred. This aggravation was ushered in by an attack of hæmoptysis, at which time half a pint of blood was expectorated. He lost, from time to time, during the month of October, an ounce or two of blood; but this was afterwards restrained by acetate of lead. At this time there were symptoms of fever; quick pulse, and great general debility; appetite bad; urine loaded with yellow lithates, not albuminous; bowels irregular; the liver and heart healthy.

On the 23d of November the signs remaining much the same, the following observations were made:—

1. *Physical signs afforded by Inspection.*—On the right side: No movements of the ribs from the third to the fifth; below the fifth the ribs are but imperfectly acted on by the diaphragm; the whole side is flattened, and a slight depression exists under the left clavicle; the cartilages of the third, fourth, and fifth ribs are drawn down, and more oblique than usual. On the left side: The expansion is fully and equably performed; no flattening or deformity of any kind; the whole of this side is on a plane anterior to the right.

2. *Afforded by mensuration.*—The diameter of the right side is two-thirds of an inch less than that of the left, in nearly every direction, save under the clavicles, where the difference is trivial.

3. *Afforded by percussion.*—On the right side, a clear sound as far as the third rib, from which point downwards the dulness is so great, that no demarcation between the lung and liver (as to sound) can be detected. On the left side: clear in every part, even preternaturally so, indicating how fully every portion of the pulmonary parenchyma is permeated with air.

4. *Afforded by auscultation.*—Over the right lung the respiration is puerile to below the second rib: there is a small râle occasionally heard, but no prolonged expiration. From the third to the fifth rib, on the same side, cavernous breathing, pectoriloquy, and gurgling, are audible, and most distinctly so at the inferior angle of the scapula. Over the left lung the respiration is puerile, otherwise quite normal; an occasional râle at the lower part at the back. A slight fluctuation perceptible on the right side on percussion; cardiac sounds normal; pulse 90 to 100; respirations, 25.

The treatment of this case was of a tonic nature, with occasional counter-irritation. Easily digestible diet, avoidance of cold and violent exercise, diaphoretics, large doses of bark and sulphuric acid, with four grains, daily, of the iodide of iron, were the means employed, under which he has daily improved, and is now nearly well.

The patient is now (January, 1848) quite well, and able to prosecute his former occupation with ease.

# LECTURE V.

*The Operation for Empyema; Ancient Mode of Operating; The Modern Methods by Trocar and Canula, and by Incision; Dr. T. Davies' Grooved Needle; Place of Election; Directions for the Operation; Comparative Success of the Operations by Incision and by Puncture with the Trocar; Admission of Air into the Cavity of the Chest; Opinions of Mr. Cock and Dr. Hughes on Paracentesis Thoracis, and on the Admission of Air into the Cavity of the Chest; M. Goze's Case of Paracentesis Thoracis for Hydrothorax; In Hydrothorax, the Puncture should be closed immediately—in Empyema, a permanent drain should be established; Dr. Th. Thompson's Case; Dr. T. Davies' Practice; The Propriety of Injecting Fluids into the Cavity of the Chest; Dr. Gibson's Case; Case by Morand; Case by Diemerbroek; Case of Dr. Wendelstadt; Case of Musket-shot Wound of the Chest; Case of Penetrating Wound by a Polish Lance; Cases of the Operation by Necessity; Messrs. Faure and Aubert's Cases of External Abscess Communicating with the Chest: Lance Wound of the Chest; Dr. F. Bird's Report of a Fatal Case of Pistol-shot Wound of the Chest, under the Care of Mr. Lynn and Dr. Roe, in the Westminster Hospital; Post-Mortem Appearances.*

The operation for empyema appears to be of a right ancient and military origin. It has not been satistactorily decided whether it was first performed on Phalereus, Jason, or Prometheus; and it is therefore said of all three, that each, being expected to die of an abscess in the lungs, declared to be incurable, went into battle for the purpose of getting himself killed, but being fortunately only run through the body, they all recovered in consequence of the escape of the purulent matter through the holes thus made. It is certain that the operation was performed by Hippocrates and his successors, by the knife, by caustic, and by the hot iron. Ambrose Paré appears to have been the first who recommended a trocar and canula, and many instances of success in all ways are recorded. The modern methods are two in number; one by the trocar and canula—the other by incision; although there are few persons in England who would now resort to incision, unless there were reason to believe some extraneous matter required to be removed, even if it were only a portion of carious rib, a consequence, by no means rare, of long-continued disease. After penetrating wounds of the chest, in which the presence of a foreign body may be suspected, if not actually known, the method by incision will be essentially necessary, as will be hereafter shewn.

The late Dr. T. Davies claimed the invention of a grooved needle for the purpose of exploring the cavity of the chest; but as a trocar and canula are made as small, they may be safely preferred; if fluid should pass through the canula, a larger one may be introduced in its place, if thought advisable. In ordinary cases, the little wound should be closed immediately after the evacuation of the fluid, and it usually heals, if small, without difficulty, and the operation may be repeated, if necessary, with greater confidence. The introduction of the instrument gives but little pain, is rarely followed by any bad consequences, and ought therefore to be had recourse to much more frequently than it is at present, and at a much earlier period. Whenever auscultation and percussion give reason to believe that a fluid is collected, which medicine has not been, nor is able to remove, the simple operation by the trocar and canula should be performed.

It is, in fact, merely an exploration. Care should, however, be taken that the point of the instrument is perfectly sharp, or it may separate the thickened false membrane from the inside wall of the chest, and, by pushing it before it, prevent the fluid from passing through the canula when the trocar is withdrawn. The place of election, in England, for a *puncture* in ordinary cases, is usually between the fifth and sixth ribs, counting from above, and between the sixth and seventh from below, and at one-third of the distance from the spinous processes of the vertebræ; or two-thirds from the middle of the sternum. If there should be any protrusion of the intercostal spaces, it may be a rib or two lower. The point of the instrument—one of which has now a place in every military case—should be introduced nearly midway between the two ribs, or a little nearer the lower than the upper, and pressed on until all resistance has been overcome. It is entered nearer the lower rib, to avoid the intercostal artery, and yet not touching the rib, lest it should induce a too forcible contraction of the intercostal muscles, when it is said the point might be suddenly raised, and broken against the upper rib, and the operator much inconvenienced. In France, Sabatier, Pelletan, Boyer, &c., reckoning from below upwards, recommend the opening to be made between the third and fourth ribs; Chopart and Desault, even between the second and third, on the left side, and the third and fourth on the right; but the diaphragm would in all probability be wounded by a trocar, unless the fluid effused were in considerable quantity; Laennec, between the fifth and sixth from above, as in England.

If the person should be very fat, or the puffing of the integuments considerable, it may not be easy to feel the ribs, in which case even, recourse should not be had to incision. When the arm is placed by the side, and bent forwards at a right angle, so that the hand rests on the ensiform cartilage, the inferior angle of the scapula will correspond in general, but not always, with the interval between the seventh and eighth ribs at the back part. The attachment, however, of the last of the true ribs, the seventh, to the xyphoid cartilage, can always be ascertained in front, and an error of importance cannot well take place, as the object in making a puncture by measurement is to avoid the diaphragm. Freteau of Nantes, in his able paper on empyema published in the *Journal Generale de Médécine* for 1813, says that Dr. Lefond and himself performed the operation on the left side between the tenth and eleventh ribs, and on the right side between the ninth and tenth in more than thirty dead bodies, and always opened into the cavity of the chest, performing it close to the edge of the latissimus dorsi muscle, or about three and a half inches from the spine, an operation which in this place should be done by incision, and not by the trocar. When there is reason to believe that there is an extraneous body to be extracted, such as a ball, the place of election is of importance, as it is desirable it should be a little above the diaphragm in order to facilitate its extraction, for although, by carefully shifting the position of the patient, a ball or a piece of bone may be brought to rest against the opening, it will not be easily taken hold of, unless it lies upon the diaphragm, a point which will be hereafter further elucidated. When an external swelling indicates the presence of matter, and there is reason to believe it communicates with the inside of the chest, the opening should be made into the tumour, which is called the "operation by necessity;" this is not an uncommon occurrence after gun-shot wounds. The operation by necessity is not always, however, done in the most convenient place, and must then be repeated lower down, which will also be sometimes necessary in consequence of the matter collected in this way, being cut off by adhesions from the general cavity.

When the operation by incision was alone performed, the success was certainly not great. Dupuytren said in his lectures that in fifty cases he had seen, two only had entirely recovered. In more modern practice the success after the operation by puncture has been much greater. Dr. T. Davies lost only four out of sixteen patients. M. Mourgery, out of one hundred and twenty-two cases collected from different sources, noted eighty-six as having been successful. Dr. Roe, in his able memoir on paracentesis thoracis, published in the 27th vol. of the *Medico-Chirurgical Transactions*, records all the cases he refers to, and enumerates the deaths as six out of twenty-four, three of the twenty-four operations, and consequently three of the deaths, being done on persons in whom recovery could not be expected. The difference between these results may be attributed to the operation by puncture having superseded that by incision, and principally from the operation having been had recourse to at an early period. Dr. Roe thinks the proper period to have arrived, when the inflammation has been subdued, and a large quantity of fluid remains in the chest, over which medicine seems to have no control, and he believes with Broussais, that this will be about the end of the third week. After wounds penetrating the chest, and which do not admit this effused fluid to flow out, it occurs much earlier.

When the operation is performed in a case of hydrothorax, or when the fluid is serous, it is generally called *Paracentesis thoracis*, from Παραξεντεω, "to perforate," under which circumstances it is possible that both sides of the chest may be affected; and it may be permitted to add, even in the present day, that both sides may not be punctured in succession, and that an error in puncturing the sonorous or sound side, instead of the dull or affected side, has been almost immediately destructive of life.

The admission of atmospheric air into the cavity of the chest during this operation, has been much deprecated, and many inventions have been recommended for its prevention; but it is scarcely possible to prevent some air getting in. It is often seen to do so; and it is proved to have done so by auscultation, and it is usually absorbed in a few hours. In one case reported by Dr. Roe, and which I saw, it gave rise to distressing symptoms, from pressure on the lung; it was removed by a common syringe, to the great relief of the patient, and without inconvenience following. In all these cases two things must be considered. Can the compressed lung expand, so as to fill the chest when the fluid is withdrawn? The answer must be, that in a great number of cases it is so bound down by adhesions that it can dilate but slowly, if at all. If it be then asked, whether a vacuum is formed in the chest, the answer will be no; and it will then be admitted, on consideration, that air always finds its way into the chest, and that it rarely does any harm. Indeed, I believe from experience, that the admission of common air never does any harm, in persons in health; and that when mischief ensues after an operation or an injury, it occurs from the irritation caused in a particular state of constitution, and not from the admission of air. If the wound into a cavity can be closed and healed, the air will remain with impunity. If the wound cannot be healed, inflammation may be propagated from it to the whole cavity with which it communicates.

Mr. Cock and Dr. Hughes published in the

Guy's Hospital Reports for April and October, 1844, a valuable paper on Paracentesis Thoracis, in which, in addition to other matters, they advocated two points, from which, with all due respect for the learning and ability they have so unequivocally shewn, I have ventured to dissent;—one is, the ill effects arising from the admission of atmospheric air; the other, the advantage to be derived from drawing off a part only of the effused fluid at the first operation, lest the air which must necessarily enter might continue to compress the expanded lung, although in a less degree. Dr. Hughes, in some papers published in the *Medical Gazette* for 1846, expresses a desire to modify these opinions to a certain extent: thus, for instance, he says—"On some occasions, when the effusion is recent, the whole of the liquid may be removed at once, without the admission of any air, from the expansion of the lung. The operation thus becomes a very tolerably correct indication of the state of the lung and of its capability of restoration, and thereby affords a substantial ground upon which to found a prognosis:" and again—"Unless the lung is capable of full and free expansion, we do not attempt to draw off all the effused fluid: we remove, indeed, only so much as the expanding lung and the surrounding compressed organs are capable of replacing. The opening is carefully watched, particularly during the acts of inspiration and of coughing; and when the stream begins to fail, the body is turned towards the punctured side, till there is at length an alternate flow and stoppage of the stream during the acts of expiration and inspiration. When this occurs we withdraw the canula; when, in fact, there exists a tendency for the external air to enter the cavity, that tendency is at once stopped by closing the aperture. Sometimes, it is true, a considerable portion of fluid is thus left behind." This fluid, if not absorbed, must be removed by another operation. The irritative quality of the air seems thus to be in a great measure given up, and it is probable that the retention of part of the fluid will follow, unless in cases attended with great debility; for if the air does not prove a cause of serious irritation, it is much less likely to prove a permanent cause of compression, than an equal quantity of fluid. Some late French writers, and especially Messrs. Raybaud and Trousseau, placing greater confidence in the evils arising from the admission of air, have lately used bags made of gold-beaters' skin, or gut, or bladder, attachable to the canula, for the purpose of receiving the fluid as it escapes, and thereby preventing the ingress of air, which the following case by M. Goze, Physician-in-chief to the Military Hospital of Marseilles, published in the 63d vol. of the *Memoires de Médécine et de Chirurgie Militaires*, 1847, would seem to show is not always followed by serious consequences.

Case 12.—L. J., twenty-four years of age, of the 51st regiment of the line, was admitted into hospital on the 27th of September, 1845, with inflammation of the chest, the symptoms of which disappeared after forty-three days of treatment, leaving those of effusion. After fifty-three days further treatment, the effusion being stationary, as well as the functional derangements which are the consequences, the left side of the chest was punctured between the third and fourth ribs, and 700 grammes or 30 ounces of a citron-coloured limpid fluid were evacuated. Previously to the operation, the pulse was small and frequent, dyspnœa on attempting to walk, dulness of the side—respiratory murmur little sensible, without noise or râle, and distant from the ear; elevation of the ribs of the left side very limited. Three bubbles of air entered the cavity of the chest during the flowing out of the fluid, in spite of the efforts made to prevent it by closing the orifice of the canula with the thumb, as the stream appeared to be about to stop. The canula was withdrawn during expiration, and the wound closed. From the day of the operation the lung recovered its functions, the pulse its natural beat, the appetite improved, strength was gained. On the 6th of December, fourteen days after the operation, respiration was as complete on the affected, as on the sound side. Sent home on leave, he was three months afterwards declared to be fit for service.

A more important question occurs in succession. Supposing that the constant admission of air does no mischief, is it more advisable that the patient should run the risk of inflammation occurring from the propagation of irritation, from whatever cause it may be excited, by keeping the wound open, and allowing a constant drain from the part, —or should it in all cases be immediately closed? In all cases of serous effusions there can be little doubt that the fluid should be evacuated, and the wound closed. When the fluid is purulent, I am of opinion that a permanent drain should be early established. It is not common for the operation to be repeated several times, without the serous discharge becoming purulent; and in such cases it usually becomes necessary at last to allow the wound to remain open, until the discharge shall cease of itself. Dr. Hughes, in the *Medical Gazette* for 1847, has related a case in which the chest was punctured, consequent on pleuritis, fifteen times—the patient eventually recovering, without a permanent drain having been established, although the serous discharge became at last more puriform. In a very instructive case, recorded by Dr. Th. Thompson, in the 27th vol. of the *Medico-Chirurgical Transactions*, the opening became permanent, after the chest had been four times punctured for the evacuation of a purulent collection. There can be no doubt, in such cases of internal disease, about the propriety of making the opening, between the fifth and sixth rib, a dependent one, by attending to the position of the patient; but having seen several cases in which an opening lower down, nearer the diaphragm, would have been more advantageous, as more likely to aid his perfect recovery when the patient was able to walk about, and even follow his ordinary occupation, I apprehend that whenever more than one opening is necessary, and the first is made between the fifth and sixth ribs, the succeeding ones should be made lower down; so that when it is thought right to leave the last puncture to become fistulous, it may be made as near the diaphragm as may be thought consistent with the safety of that part.

When a doubt exists as to the probability of more than one puncture being sufficient, and it seems likely that a third, or even more, will be required, the surgeon will perhaps do well to anticipate this necessity, by keeping the wound open. Dr. T. Davies, whose cases were very successful, did this, by introducing a piece of gum elastic catheter through the canula into the chest, to the extent of about three inches, enough being left outside to admit of its being secured by tapes and adhesive plaster. He says he never saw the gum catheter do harm, and he drew off through it a certain quantity of the fluid daily, until it ceased to be discharged; the elastic tube bending with the heat, and applying itself to the inside of the ribs. Whenever, in such cases, the lung rubs against it, which can be ascertained by a blunt probe, it should be removed, and the external wound kept open by a shorter and softer plug. In all these operations, care should be taken to prevent the occurrence of inflammation. The accession of pain in the part, of difficulty of breathing, of fever, should be met by cupping to a few ounces, by dry cupping, by mercury in small doses, by rest, by diet, &c., and if a plug has been introduced, it should be removed.

The propriety of injecting stimulating or even simple fluids into the cavity of the chest has been often advocated, and as frequently repudiated. It appears to me that warm water or milk and water are alone admissible, and that only when there seems to be an adventitious cause, keeping up the irritation, which may perhaps be brought to the opening by the sudden abstraction of the injection. My excellent friend, Dr. Gibson, Professor of Surgery in the University of Pennsylvania, says, in his Practice of Surgery, vol. 1, page 116, that he has succeeded in floating out with the matter pieces of cloth and bits of exfoliated bone by throwing in an injection of tepid milk and water. He says that in the case of the late Captain G. of the U. S. Navy, wounded in a duel in 1810, his health improved so rapidly under their use, that he was able to take the command of a frigate at sea, where he remained for several months, with very little inconvenience. Finally he died, partly from constitutional irritation, partly from the reproduction of matter, and the detachment of portions of carious ribs and vertebræ, which found their way into the chest, lodged on the diaphragm, and could not be removed, he being averse to a counter opening being made, as proposed by Drs. Parsons and Gibson, who, on examination after death, thought that if the operation had been done, he might have recovered.

It is obvious that matter had been long pent up in the chest, that nature had made many efforts, before the ribs became carious, to evacuate it through the thick and hardened pleura, by ulceration. The operation in this case ought, I apprehend, to have been done between the eleventh and twelfth ribs behind.

Mr. Quekett has lately had an opportunity afforded him of injecting the false membrane, formed upon the pleura of a cheetah, an animal of the leopard species, which died at the Zoological Gardens, of empyema.

In this case, the membrane covering the right side of the chest was upwards of one-eighth of an inch in thickness, and the vessels, which were very numerous, were found to be very readily filled from the arteries and veins. The membrane itself could be peeled off from the pleura with little difficulty. The fluid found in the chest contained flakes of lymph floating in it, and when examined microscopically, was found to consist of numerous pus globules or cells, with lymph particles and globules of oil; the flakes, and the last portions of the false membrane deposited, were clearly made up of lymph particles, whilst that which was first deposited, and into which the arteries penetrated, had assumed more of a fibrous than a cellular character.

Case 13.—by Morand.—A clergyman attacked by pleurisy in March, 1751, was reduced at last to that state of oppression of the chest, that he could hardly move, spit, or speak, and was supposed to be dying. Morand, who saw him on the 7th of May, finding that the whole left side was œdematous, decided on puncturing it, which he did to the great relief of the patient, evacuating six pints of serous fluid mixed with purulent matter. The distension of the chest rapidly returning, an opening was made into it seven days after the first puncture, and five pints of fluid, containing more pus than before, were evacuated. The wound was kept open by a tent of lint introduced for several inches into the cavity of the pleura. He suffered very much after this, and became so much emaciated that his life was once more despaired of. About the middle of June he began again to improve, the lint could only be introduced with difficulty, and a flat silver tube was substituted for it, through which the cavity of the chest could be washed out. After the 7th September the wound was dressed but once a day, the discharge being principally serous until the 15th November, when it became entirely purulent until the 25th December, when the wound closed, and the patient recovered his health. Morand remarks that there were very few instances known of recovery after the operation for empyema, and that when he was in the habit of using the silver tube, he was astonished to find that it was always introduced to the extent of four or five inches without touching anything, and that the fluid should not be evacuated therefrom at once, that the lung might have time to recover itself gradually. He was not aware of the manner in which it was permanently compressed, and fastened back to the spine. This case, nearly one hundred years old, shows that the chest was at that time punctured, that when it filled again it was opened, and the matter was allowed to run out daily. Morand was also aware that the lung was collapsed and compressed. He seemed to be acquainted with every leading fact, save that the cure was effected by the falling in of the chest.

CASE 14.—Diemerbroek, in his *Historia de Empyemate*, relates a successful case treated by operation, after an attack of pleuritis, indicates the symptoms common to such complaint, and the mode of cure, and among other directions gives the following, that if the collection of matter should not be removed by the remedies employed, in the course of two weeks, recourse should be had to the aid of surgery; that an incision should be made in the side, between the fifth and sixth ribs, large enough to insert a silver tube, which is to be retained in its place by proper bandages, and closed by a plug until it be thought right, from time to time, perhaps morning and evening, to let out the matter; the tube to be retained until matter has ceased to flow through it.

CASE 15.—Dr. Wendelstadt, of Hersfield, in the year 1810, and in the twenty-third year of his age, suffered an attack of pleurisy which became chronic, and ended in effusion. After severe suffering for six months, he was able to attend to his professional duties. The ribs of the right side protruded, but the intercostal spaces did not; the whole side was motionless on respiration taking place. The circumference of the chest continued to increase, and fluctuation within became evident on succussion. In June, 1819, having undergone another attack of pleurisy, he submitted to the operation for empyema, as offering some hope of preserving life. When a pint of fluid had been discharged the wound was closed; and he experienced great relief. The next day a third of a quart was taken away twice in the day, and on the third day as much more, but he thought this was too much, as he became greatly exhausted, and feared that suffocation was impending; he was recovered by stimulants. On the fourth day the fluid was thicker in consistence and fetid, and continued more or less so for a fortnight. It was then allowed to flow as it would at each dressing. Astringent injections were used for six weeks, but were then abandoned, and he gradually recovered his strength. Thirteen years afterwards, in 1830, the wound was still open, discharging twice a day, sometimes only half a drachm, sometimes three or four ounces daily. The right side had altogether shrunk, and did not move on inspiration; he had no cough, and was otherwise in good health; a piece of a rib became loose, and was removed at the end of thirteen years, when the report of the case terminated, the patient being in health.—*Journal der Praktischen Heilkunde*, 1831.

It may be remarked on this case, that the admission of air did no harm; that the lung remained compressed; that the whole side thickened and flattened, as a consequence, so as to obliterate the cavity; but the cure would not have been even then effected, if the piece of carious rib had not been discovered, and removed. Death, it may be presumed, would have followed its lying long in the cavity, and keeping up a constant irritation and discharge.

CASE 16.—Mr. Winter, secretary to Admiral Sir C. Napier, on the 5th July, 1833, when he took the fleet of Don Miguel, was wounded by two musket-balls, one in the arm, and one which entered between the inferior edge of the left scapula, and the thorax, which it penetrated, fracturing a rib in its progress, and lodged. He fell, and spat up some blood, and as symptoms of inflammation supervened in twenty-four hours, he was bled largely, and this was repeated frequently until these symptoms were subdued. He was after a time sent to the Marine Hospital, Lisbon, in a miserable plight, suffering from hectic fever, with a flushed face, hot skin, glassy eye, great prostration of strength, cough, restlessness, dyspnœa, and copious night-sweats. The wound discharged a watery, sanious, fœtid matter, in quantity, and he was unable to do any thing but eat, and for food he had a great craving. From this state, under good treatment, he gradually recovered his strength, and on the 18th June, 1834, a piece of the rib was removed. The wound remained open with a great purulent discharge, which kept him in a reduced state; and a little more than one year after the injury, he reached London, and was taken into the Westminster Hospital. I found the left side of the chest flattened and contracted, and the lung doing very little in the respiratory way, as far as could be discovered by auscultation: the wound discharging a quantity of matter, which he could readily evacuate by making the opening the dependent point, but not otherwise. On enlarging the external wound, so as to make the opening into the chest direct, I found I could pass a round-pointed gum elastic bougie into it for four inches, and, on bending it down, for six inches more, it having to pass over a thickened pleura, and false membrane of an almost cartilaginous nature, for the extent of an inch, before it could be felt to be in a large cavity. As it did not appear to me that he had any chance of recovery unless another opening was made lower than the sixth rib, in a more dependent position, I proposed the operation to him, but he would not submit; and after a time he left the hospital, and went into the country, where I was informed he died, hectic.

CASE 17.—A non-commissioned officer, of the 2nd division of cavalry, was wounded at the battle of Albuhera, on the 16th July, 1811, in several places, by the lances of the Polish cavalry, one of which penetrated the left side of the chest behind, immediately below and before the inferior angle of the scapula. He spat and coughed up blood, and lost so much from the wound, that he became insensible, the bleeding having been stopped by some of his shirt bound upon it tightly by means of his woollen sash. Brought to me at the village of Valverde, my attention was drawn to him some days afterwards, in consequence of his having got worse under his treatment, the difficulty of breathing having increased, so that he was obliged to be raised nearly to an upright position, as well as from his inability to rest on the part wounded, from the dark blue inflammatory swelling which had taken place, the wound having closed. I did not hesitate to make an incision into it, when a quantity of bloody purulent matter, and clots of blood, flowed from it. The incision was then enlarged, so as to allow of a direct opening into the cavity of the chest, which was ordered to be kept open. The relief was immediate, and the symptoms were soon restored to the state of those in other persons who have an open wound in the chest. He was removed to Elvas, doing well some three weeks afterwards.

This case offered the nearest approach I have seen to the ecchymosed œdema described by Valentin as accompanying effusions of blood into the cavity of the chest, and, with the following, are instances of operations, not by election, but by necessity.

Case 18.—A French soldier had been wounded at Almarez, by a musket-ball, which went through the right side of the chest, in a line nearly horizontal from a little below, and to the outside of the nipple, backwards. The first symptoms having subsided, although much neglected, he gradually descended the Tagus to Lisbon, where after some months of continual discharge, the wounds closed, first the back, and then the front. He did not recover his strength, always looking sickly, and suffering from pain, difficulty of breathing, and other inconveniences which did not prevent his walking about in the confinement to which he was doomed as a prisoner of war. My attention was drawn to him by Dr. Dos Santos, a Portuguese Physician who had been educated in Edinburgh, and who was in charge of the Hospital, at one of my visits of inspection, in June, 1813, in consequence of an obvious fullness of the intercostal spaces, of the great difficulty of breathing, and of a puffy inflammatory swelling which was forming around, and at the seat of the wound in front. Into this I made an incision, and as soon as it was deep enough, it opened into the cavity of the chest, the walls of which, on introducing the finger through the opening, appeared to be very much thicker than usual. A large quantity of pus was discharged, and the man was relieved, but this amelioration was not of long continuance, and he gradually sunk and died. On opening the body, the inside of the wall of the chest was found to be half an inch in thickness in consequence of a firm deposition on the pleura of a yellowish ash colour, honeycombed or ulcerated as it were in plates, and particularly where the opening had been made. The lung was shrunk up from the anterior and lower part of the chest, but adhered to the wounded part behind, and was covered by a layer of false membrane of considerable thickness. The wound through the lung could not be distinctly traced, from its being throughout diseased.

Case 19.—At Santander, in October of the same year, 1813, I received some eight hundred wounded in the affairs of Le Saca, Vera, &c. One of the light division had been shot through the left side of the chest, in a nearly similar manner; the posterior wound had closed, but a sufficiently large quantity of matter was discharged through a small anterior one to shew that there must be some depôt from which it proceeded. I therefore directed the wound to be laid open, and as soon as I saw that its course was into the chest, I enlarged the opening into that cavity, and gave free vent to a quantity of matter, thus affording great relief. Some small pieces of rib were discharged, and a bit of something like the cloth of his coat also came away. He could lie on either side, and hopes were entertained of his recovery until after I left Santander, in December, to join the army in France, when he suffered a relapse of inflammation, and died. No dissection, I learned to my regret, was made.

M. Faure, in his Inaugural Thesis, published at Paris, in 1814, gives the case of a man in whom pleurisy terminated in the formation of an external abscess, as large as the closed hand, on the right side, beneath the pectoral muscles. On being opened, it discharged a pint of purulent matter, and was found to communicate with the cavity of the chest. Death followed soon after. The cavity of the pleura of the right side contained eight ounces of pus; the lung was compressed to the size of the fist; the pleura lining the wall and covering the lung, were both coated by false membranes.

M. Aubert, in another case of a similar kind, published in the same Thesis, opened the chest on the 17th July, and the patient, after many accidents, recovered his health in the May following.

Case 20.—A soldier of the German Legion, had been wounded at Waterloo, by a lance, between the sixth and seventh ribs of the left side. He spat up much blood for several days, and was carried to Antwerp, where he remained for several months, suffering from great difficulty of breathing and other distress in his chest, which recurred from time to time, although his wound had healed. He was admitted into the York Hospital, Chelsea, in the spring of 1816, from the barracks in the Savoy, where he was awaiting the award of his pension, in consequence of an attack of inflammation, of which he died. On examining the body, the lung of the right side was found to be greatly inflamed and full of purulent fluid, which caused his death. The left or wounded side was found to contain a small quantity of pus, the cavity being very much diminished, by the great thickening of the pleura, and the falling in of the ribs, which were also thicker and greatly flattened, and consequently changed in their form; the lung shrunk or collapsed, was covered by a thick adventitious membrane, and bound down against the spine, leaving a long small space, which once had been doubtless full of matter. The mediastinum and heart appeared to lean towards the right side, aiding in this manner in the obliteration of the cavity, which must take place if a permanent cure is effected in empyema. I have seen two cases in which this obliteration appeared to be complete; one in a soldier, who had been wounded in the chest,—one in a gentleman, the subject of empyema, in private life. In both the spine was also distorted, the side wasted, the nipple lower than the other. The breathing of the opposite side more marked and developed. It might have been called puerile. I have never had an opportunity of examining a case of the kind after death, in which a cure had been long effected. In both these it took nearly three years to accomplish.

Case 21, by Dr. Frederick Bird.—William Griffin, æt. 18, admitted into the Westminster Hospital Sept. 14, under Mr. Lynn.

Ten days before his admission into the hospital, whilst labouring under great mental excitement, he discharged a pistol against the left side of his chest. A wound corresponding to the middle of the eighth rib was produced, from which a very small quantity of blood escaped, but was immediately followed by vomiting and fainting. The medical practitioner who was called to him at the time *passed a probe to the extent of four inches* into the wound.

The wound had nearly cicatrized, but he became the subject of acute pain, diffused over the whole of the left side of the chest, accompanied by fever and frequent cough, dyspnœa, and inability of lying on the right side. After the lapse of a week he was transferred to the medical wards, under Dr. Roe, at which time he had begun to expectorate purulent matter of an extremely fœtid character, occasionally mixed with blood. His respiration was hurried, the right side of the chest expanding much more freely than the left; the lower three-fourths of the affected side were dull on percussion; tubular respiration could be detected at the upper part, but at the lower part no air appeared to enter; well-marked modification of voice existed over the whole of that side of the chest. By measurement no difference in the relative size of the chest was observed, but the intercostal spaces of the left side remained motionless during expiration. The heart could be felt feebly pulsating at the epigastrium.

Oct. 15.—Had been slowly improving until this evening, when he suffered from a violent paroxysm of coughing, during which great dyspnœa suddenly came on. He sat propped up in bed, his respiration was almost ineffectual, his face livid and covered by a cold clammy sweat, pulse scarcely perceptible at the wrist, and his extremities were becoming cold. On examining the chest, the left side, before quite dull, now afforded tympanitic resonance on percussion, which, together with the total loss of respiration, and the presence of metallic tingling, proved the existence of pneumo-thorax. I introduced a trocar between the sixth and seventh ribs, which was followed by an escape of gas, with about five drachms of pus, both of a very fœtid character; the canula becoming obstructed, a larger one was then passed through the opening, but not more than half an ounce of pus escaped; it was then withdrawn, and found to be blocked up by what appeared to be disintegrated lung. As he was now greatly relieved, no further attempts at evacuating the fluid were made.

16th, 2 a.m.—Two hours after the operation. Respiration has become much easier, heat of surface is quickly returning, and his pulse is becoming more full.—4 a.m. Has had a paroxysm of coughing, during which six ounces of fœtid pus escaped by the opening, after which he felt relieved.—10 a.m. A second gush of sanious fluid, to the amount of five ounces, containing small masses of sloughing membrane, took place. Cavernous respiration can be now heard at the upper half of the lung, mixed with gurgling and metallic tingling Expectoration is muco-purulent and offensive.

17th.—Since yesterday seventeen ounces of pus have passed through the wound. He is altogether improved.

18th.—Diarrhœa has supervened, under which his powers are rapidly diminishing.—Vespere. Has vomited, during which six ounces of pus were forcibly ejected by the wound.

19th.—The diarrhœa has been arrested by the use of opiate enemata, but he appears more prostrate. The discharge from the wound continues at intervals.

21st.—Has somewhat improved; not more than three ounces of matter have escaped since the last report. He suffers from accessions of fever towards evening, and perspires very profusely during the night; the cough is less frequent, and he expectorates freely, the sputa being of the same purulent fœtid character. Scarcely any discharge now takes place from the side.

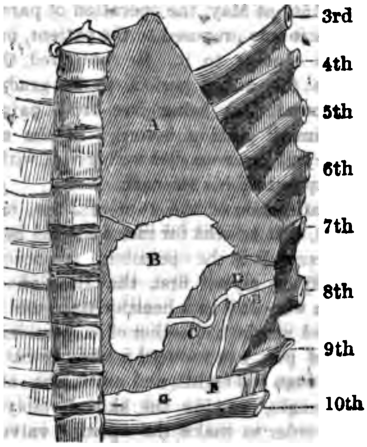
Nov. 5th.—Has remained in nearly the same condition until yesterday, when he ceased to expectorate, and has since become much worse; his skin is now intensely hot, face flushed, tongue brown and coated, pulse jerking, but feeble and frequent; the opening in the chest has quite healed.

A second opening was now made about an inch external to the former one, and a canula introduced, but not more than one ounce of pus escaped, the instrument becoming blocked up by portions of sloughing tissue; during a paroxysm of coughing which occurred a few hours afterwards, several ounces of fœtid sanguineous pus were forced through the wound.

8th.—Has been much relieved since the last operation, and he has now again began to expectorate freely, as much as a pint and a-half of extremely fœtid purulent matter, mixed with opaque masses more or less moulded by the bronchial tubes through which they have passed, having been coughed up during the night. All the physical signs of a large cavity in the lung can be now distinctly heard. Not more than five ounces of pus have escaped through the opening.

16th.—Since the last report he has been slowly sinking—is emaciated to an extreme degree. The wound originally produced by the pistol ball, as well as those made by the trocar, have become fistulous, so that, during respiration the air passes into the chest, and is expelled with as much freedom as that passing by the trocar. Expectoration has continued very copious, about a pint and a-half having been passed in each twelve hours—large sloughs have formed upon the nates and hips, his intellect wanders, and he has frequent syncope.—Died on the 5th of December.

*Sectio Cadaveris.*—The pleural cavity of the left side contained about ten ounces of purulent matter mixed with blood, and having floating in it numerous masses of white curd-like matter, at the bottom of which in the angle formed by the diaphragm with the spine, was found a pistol ball, partly covered by albuminous matter, and discolored. Fluid injected into the left bronchus was found to issue freely from an opening at the most depending part of the lung, communicating with a small cavity, the interior of which was lined by the same thick membrane met with in cases of chronic phthisical disease; from the upper part of this cavity two other sinuses were found, the one passing externally, and terminating by an adhesion of the lung with the ribs, at the point where the ball had entered; the other was longer and more tortuous, passing deeply into the substance of the lung, and ending in a large abscess capable of containing five or six ounces of pus. The lung was at its lower part, firmly attached to the ribs by intervening false membrane, whilst the upper part was free, and had become compressed towards the spinal column. The substance of that part of the lung, not involved in the abscess, was infiltrated with pus, and the greater number of the bronchial tubes were filled up by masses of curdy matter, similar to those found floating in the effused fluid. The natural division of the lung into lobes was quite destroyed by the pleuritic adhesions of one to the other, whilst the pleura lining the parietes was covered by rugged layers of false membrane of irregular thickness, and readily detached. No trace of tubercular deposit could be found, and the lung of the opposite side was quite healthy.



A. Section of the lung, made vertically. B. section of the abscess communicating by the sinus (C.) with the circumscribed cavity. (D.), in which the bullet had been lodged after its entrance by the sinus (E.)

F. The sinus by which the ball had passed into the pleural cavity (G.)

Opposite the 7th and 8th ribs, the lung is quite adherent.

## LECTURE VI.

*Dr. Maclean's Cases of Empyema; Conclusions respecting the operation of Paracentesis Thoracis; Dr. Edward Barry's Operation for puncturing Abscess of the Lung; Performed successfully by Mr. Tuchy; Revived by Dr. Hastings; Sir Henry Marsh's Case; Pneumo-thorax: Symptoms and Consequences of Pneumo-thorax; Signs by Succession and Percussion; Tintement Metallique; Mr. Kelly, of Leith, the first person who operated for Pneumo-thorax; Dr. Davy's Case; Case of Mr. Cornish; Dr. Roe's Case, reported by Dr. F. Bird; Case of Lord Beaumont; Dr. Houghton's opinion respecting the cause of the Tintement Metallique in Pneumo-thoeax; The Operation only palliative when the Pueumo-thorax is caused by a Tubercular Abscess; Curative when it has been induced by a local injury.*

I am indebted to Dr. French, the Deputy Inspector-General of Hospitals, at Chatham, for the three following cases treated there, by Dr. Maclean, staff-surgeon. They are highly creditable to the ability of Dr. Maclean, and shew the care and attention which is taken of sick soldiers, when not too numerous for the doctors employed. The last case is particularly interesting from the manner of recovery.

Case 22.—Private Patrick Kenny, aged nineteen years, 86th regiment, admitted 12th April, 1847, with pleuritis.

Had been ailing for several days previously to his admission; complained chiefly of general febrile symptoms, and of pain on the left side of the chest. The following day he was bled freely from the arm, with immediate relief. This treatment was followed up with a full dose of calomel, antimony, and opium. He passed a good night. but in the morning the pain in the right side returned, situated under the left mamma, and extending backwards to the subscapular region.

On the third day of his admission, acute pleuritis was for the first time diagnosed, and was treated accordingly, with general bleeding, calomel, antimony, opium, and counter-irritants. Up to the 1st of May he had been twice bled from the arm, which was followed with marked relief. On the 3rd of May he is reported free from all pain; breathing easy and natural; general appearance healthy.

He continued in a convalescent state until the 8th of the same month, when he had a return of all his former symptoms, with frequent cough. Percussion elicited a clear normal sound on the right side, and on the ear being applied, the respiratory murmur was distinct, and louder than natural. On the left side, in the sub-clavicular region, it was also clear; but beneath this, and extending downwards and backwards, there existed a decided dullness on percussion; and on applying the ear to the stethoscope, the respiratory murmur was heard as if from a distance. The dullness extended towards the mammary and subaxillary regions, and round towards the posterior parts, as far down as the the tenth rib. His general health became considerably affected by frequent attacks of diarrhœa, which continued for some time, with occasional relief from the exhibition of the different remedies. From this period, however, the pleuritic effusion of the left side became every day more distinct; although he complained very little of either pain or cough, yet his breathing was becoming more hurried, and his recovery more hopeless.

On the 15th of May, the operation of paracentesis thoracis was proposed to the patient, but he would not consent to it. He continued, therefore, from the above period, to be gradually losing ground; but being free from pain, he fancied himself getting better. In the mean time, wine and generous diet were given, with the view of supporting his strength.

On the afternoon of the 10th of June, he became so ill, that he sent for me, and said he was willing to submit to the operation. Accordingly, after satisfying myself first, that the right lung and pleura were still in a healthy state, and feeling assured of the collection of a considerable quantity of pus, I introduced a large trocar and canula between the eighth and ninth ribs, at the posterior angle, drawing the skin forcibly upwards, in order to make the opening valvular; and immediately on removing the trocar, a full stream of laudable pus, of a cream-colour, issued from the canula, flowing in jets corresponding to the contractions of the chest. Of this fluid fourteen ounces were withdrawn, when it was thought advisable to close the opening, and apply a light bandage. The patient bore the operation well, and expressed himself greatly relieved. The breathing became more free and easy, and the natural expression of his countenance returned. The pulse increased in strength and fullness, and he passed a better night than he had done for many weeks.

On the 17th, the side was again opened, and thirty-two ounces of pure pus withdrawn, with increased relief. The wound was treated as before, and allowed to heal by the first intention. The diarrhœa now entirely ceased; his bowels became regular, and appetite much better; breathing easy; pulse 90, and easily felt; tongue clean and moist.

18th. Passed a good night; no cough or expectoration; says he feels easy and comfortable; breathing natural; bowels regular; asked for a piece of beefsteak for breakfast, which he ate with a relish; urine clear and natural. For the first time since the operation an examination of his chest was made—the left side still remained dull, though in a less degree. On applying the stethoscope to the chest a loud amphoric sound was distinctly heard; no gurgling accompanied this sound, and it was therefore supposed to arise from a small opening from the bronchial tubes, into the pleural cavity, above the level of the fluid.

19th. Continues to improve in every respect. In the evening, his breathing was observed to be somewhat hurried; the side was again opened, and eight ounces of thick pus evacuated, after which he appeared much relieved, and passed a good night.

20th. Appears easy, and much stronger. On the bandage being removed from the wound, and a director introduced, no pus flowed; half-an-ounce of castor-oil was given, and in the evening, twenty-five drops of sol. mur. morph.

21st. Slept well; countenance expressive of ease and cheerfulness; breathing easy; appetite good; bowels open; pulse 86, of better strength. —Vespere: not so well; breathing rather hurried. The chest was again opened, and one pint of pus taken away, with the most marked relief.

22nd. Passed a good night, and looks well; has taken his breakfast with relish, consisting of coffee, bread and butter, with two eggs; no pus withdrawn to-day.

23rd. Looks very well, and slept well during the night; but his bowels are rather free, having acted four times before breakfast. Hab. tinct. opii m.x., tinct. catechu ʒi.

*Vespere.* Has been sleeping a good deal all day, but still his appetite and spirits continued good, and his general appearance much improved. At 8 o'clock he said he felt hungry, and asked one of his comrades to boil him an egg; on his coming back with it boiled, the patient was dead.

SECTIO CADAVERIS, HORAS VIGINTIQUATUOR POST MORTEM.—*Head.* Brain and investing membranes healthy.—*Thorax.* The *right lung* presented throughout the appearance of general acute bronchitis; pleura healthy. The *left lung* was firmly bound to the walls of the chest, at the apex and lower half, by recent thick adhesions; the substance of the lung was compressed to about half its normal size, but remained throughout permeable by air; the pleura was much thickened throughout, by a layer of coagulable lymph, covered with purulent matter, and formed by the adhesions at the lower border and apex, a large cavity containing pus; at the lower part of this cavity the opening existed through which the fluid was evacuated; the heart was slightly enlarged, but otherwise healthy; the liver, and other abdominal viscera, quite healthy.

CASE 23.—Private Michael Donohoe, 29th regiment, aged eighteen years, admitted 13th June, 1847, with pleuritis.

The general febrile symptoms appear soon to have given way, under the exhibition of sol. antimonii tart. and saline purgatives, and the pain of the left side appears to have been successfully treated, by the application of a few leeches and a blister. The patient is reported to have been going on favourably up to the 10th of July, 1847; on which day he is stated to have contracted a slight catarrhal affection, accompanied with diarrhœa.

Upon the 12th of August, 1847, I found the patient suffering from constant diarrhœa, with watery, slimy evacuations, loss of appetite, and general debility. He complained of slight tickling cough, accompanied with scanty, seromucous expectoration; pulse 120, weak and irregular; breathing observed to be short and hurried. Said he felt acute pain on the top of the left shoulder, and a sensation of great weight over the precordial region; no pain of left side.

On examination of his chest, found extensive and complete dulness of left side, commencing from the sub-clavicular region, as far down as the ninth rib, which continued round posteriously, to within a short distance of the spinal column. On the application of the stethoscope over the same space, the respiratory murmur could not be heard, and was only slightly audible in a small space, in the subscapular region, where it was accompanied with loud bronchial respiration. The heart's sound and impulse were very obscure over the precordial region, but were heard and felt distinctly on the *right* side; the entire left side appeared bulged out, and was so œdematous that it was with great difficulty the ribs could be felt or defined; and between the scapulæ ægophony was distinctly heard, but no sound on succussion could be elicited, which was supposed to be owing to the pleural cavity of the affected side being filled with pus; the right lung and pleura appeared healthy; respiration puerile.

On the 13th August, the operation of paracentesis thoracis was performed between the seventh and eighth ribs, and forty ounces of healthy creamy pus flowed through the canula in eight minutes; it was then withdrawn, and the wound closed. The patient expressed himself greatly relieved by it. His pulse fell from 130 to 96; his breathing became more free and easy, with complete relief to the pain of his left shoulder. No medicine. Was ordered to have two gills of wine during the day, and beef tea.

14th. Has passed a good night, and slept well, without any anodyne draught; bowels once moved since the operation; breathing easy and natural; no pain or discharge from the side, the œdema of which is greatly diminished; pulse 90, soft and regular.

15th. Slept well; breathing easy; countenance cheerful; appetite improving; great dullness still on percussion. The trocar and canula were inserted between the eighth and ninth ribs, and two pints of healthy looking pus withdrawn. The patient expressed himself much relieved of the oppression at his heart, and the pain of the shoulder; pulse 94; weak.

16th. Passed a good night; breathing easy; bowels regular; appetite good; and the dullness on percussion is much less; but the respiratory murmur is only heard in the sub-scapular and dorsal regions. Was ordered to take a draught, composed of the infusion of gentian, with the sesquichloride of iron twice a day, and a mutton chop in place of the beef tea, with two gills of wine.

From the above date to the 20th of September, 1847, he continued to make considerable progress in his general health and appearance, notwithstanding that, from time to time, large quantities of pus were withdrawn, according as his breathing was affected, and the dullness on percussion was increased.

On the 21st of September, a sudden change took place in the weather, from very fine and dry to cold and wet; and without any other apparent cause, the patient was attacked with acute bronchitis of the right lung. At this time the left side was clear on percussion, and slightly tympanitic; and the respiratory murmur was heard over a larger space posteriorly. His breathing easy and natural; appetite good, and bowels regular; pulse 90, of moderate strength.

From this period the patient became rapidly worse, and notwithstanding the means employed to overcome the bronchial affection of the right lung, it still continued, and brought the case to a fatal termination upon the 27th of September, 1847. The quantity of pus taken away altogether measured twenty-four pints three ounces.

SECTIO CADAVERIS, HORAS VIGINTIQUATUOR POST MORTEM.—*Thorax.*—On removing the skin and attenuated fibre from the left side of the thorax, the sterno-clavicular articulation was found loosened, and partially dislocated, the edge of the fifth rib was ulcerated, and the cartilage of the third rib was separated from the rib itself by ulceration; the left lung was found about the size of a large spleen, bound down and compressed against the spinal column; its structure healthy and permeable by air. The pleura was covered with a thick layer of lymph throughout; and its cavity contained eight ounces of pus; right lung slightly bronchitic, otherwise healthy; pleura also healthy. The heart was found pushed to the right, otherwise healthy. The abdominal viscera were all found in a natural condition, with the exception of the caput coli, which shewed marks of inflammation and slight ulceration.

CASE 24.—Private Michael Quinlan, 94th Regiment, admitted, 29th April, 1847, with fever.

The febrile attack was of a severe character, principally affecting the brain, which became so far excited, that for several days he was in a state of high delirium, and was placed under antiphlogistic treatment, with a free application of leeches to the head. The urgent symptoms were subdued, when after an imprudent exposure, he was attacked on the 5th of June, 1847, with well-marked pleuritis of the right side, being, at the time, in a debilitated state from the effects of his late attack of fever. The treatment was confined to local depletion, and counter-irritants which removed the acute symptoms, but were followed by those of a chronic character, attended with marked deterioration of the patient's general health and appearance. He complained of frequent cough, especially in the morning, before getting up, with a free expectoration of a sero-mucous character.

On examination with the stethoscope, the vesicular murmur could only be heard in a very indistinct manner, and on percussion over the same space, the sound was perfectly dull, with increased resonance of the voice. The left lung and pleura appeared quite healthy, but the action of the heart was somewhat increased, and its impetus could be felt over a much larger space than is usually found in the healthy state.

He continued getting worse up to the 17th of August following, during which time there did not appear much change in the physical signs, as described above. Both sides were measured, but only the slightest possible increase could be detected in the right. The only part of the affected side, where the respiratory murmur could be heard, was a small space between the dorsal and sub-scapular regions. The patient feeling conscious of his sinking state, consented, after much persuasion, to the operation which he had hitherto always declined, and a large trocar and canula were introduced at the posterior angle, between the eighth and ninth ribs, drawing the skin forcibly upwards to make the opening valvular, when a quantity of fœtid thick pus was withdrawn, which came away with difficulty. The patient experienced the most marked relief in his breathing; which, before the operation, amounted to orthopnœa. He bore the operation well, and said he scarcely felt it. His pulse fell from 120 to 90, and increased in strength; sol. mur. morph. m. xxv., h. s. He passed a good night, but awoke suddenly, about 5 o'clock the following morning, with a sense of suffocation, which terminated in a fit of coughing, when suddenly a large quantity of thick pus flowed out of his mouth, which on being measured exceeded four pints. The relief the patient experienced surprised himself and everybody else. His breathing became easy and natural; pulse 90, and of moderate strength; bowels open, and regular. The following morning, the bandage was removed from the wound in the side, but no appearance of any discharge shewed itself. On examination with the stethoscope, loud amphoric breathing was now heard over the right mammary region, and the respiratory murmur was audible over a larger space than before the operation. He said he had little or no pain in his chest, with hardly any cough. Two ounces of the infusion of gentian, with the sesquichloride of iron, were given twice a day, and according as his appetite increased, a liberal diet with a little wine was allowed. On the three following days after the operation, a small quantity of pus was visible with his sputa, which afterwards disappeared. The respiratory murmur, over the affected side, gradually extended itself from above downwards; with less dulness on percussion. The amphoric breathing remained distinct for many weeks, without apparently affecting the progress in his general health, which continued to improve during the whole time he remained in hospital.

He was discharged to duty upon the 8th of November, 1847, on which day the following remarks were made. Appears in perfect health, and since the 1st of October, has expressed himself entirely free from pain, weakness, or inconvenience. On examination of his chest, there is a considerable amount of dulness on percussion, over the lower and anterior portion of the left lung, and over the same space the vesicular murmur is only indistinctly heard. Right lung healthy; but the respiratory murmur slightly *puerile;* heart's impulse somewhat increased; pulse 86, soft, and natural; bowels open; tongue clean and moist; general appearance perfectly healthy and natural; limbs muscular.

He has, since the above period, continued performing his drill and duties as a soldier, and on the 15th of January, 1848, when last seen, he said he was quite well, and never felt better in his life.

A. MACLEAN, M.D., Staff-Surgeon, 2nd Class.

I have been acquainted with a gentleman for five-and twenty years, whose lungs have been declared during that time, by French, English, and Italian stethoscopists, to be reduced to nearly nothing, who, independently of an ordinary cough and muco-purulent expectoration, suffered from a more or less acute attack occasionally, which ended in his spitting up in a similar manner half a wash-hand basonful of pure pus. This I have seen and known him do several times, and his life was in all probability preserved by an opening taking place from the lung into the cavity of the pleura containing pus; after the evacuation of which each time, he rapidly recovered, contrary to all expectation. He has been in Ireland for the last six or eight years.

It may be concluded, from the foregoing observations, that in cases of paracentesis thoracis, for a medical disease, the operation for the removal of the fluid effused should be done early, before the lung is permanently compressed and bound down by the formation of false membranes to the spinal column —that the operation should be a puncture between the fifth and sixth, or sixth and seventh ribs, made by a very small trocar and canula, and the whole of the fluid should be evacuated, unless there be reason to believe its sudden removal might deprive the heart and great vessels of a degree of support necessary for their safety. The puncture should be immediately closed, and the admission of air may be prevented as much as possible, even if it should do no harm, although a time may arrive in which, after future operations, particularly if the discharge becomes purulent, it will be desirable to enlarge the small wound thus made, and keep it open. In a surgical empyema, the operation done is often that which has been called "by necessity," or at the spot where the opening into the chest originally was, or the matter now protrudes. When an operation is necessary, in consequence of a foreign substance being contained in the chest, which it is desirable to remove, in opposition to the more simple case of serous or sanguineous effusion, it should be done by incision, at the lower part of the chest behind, and requires the particular consideration which will be given to it in a future lecture.

Dr. Edward Barry, who was Physician-General to the army in Ireland, published a book in 1759, on the Digestions and Discharges of the Human Body, and the Diseases of their principal Organs; in which he advises an opening being made through the wall of the chest into an abscess of the lung, which should appear to be incurable except by extreme measures. He says, page 409, "such abscesses or ulcers in the lungs generally adhere by a large surface to the pleura; that when this membrane has not originally been engaged with an inflammation, and afterwards suppurated, it is greatly thickened and hardened; that purulent matter is always contained under that indurated part." The thickness and induration of the pleura he thinks a sign by which the operator may be guided after he has divided the soft external parts. If this is ascertained, he considers it a certain external mark of the seat of the internal disease; a fact which auscultation and percussion, followed by the use of the small trocar and canula would, in the present day, certainly demonstrate in time to prevent the evil of opening the chest in search of a cavity which might not exist. He refers to one case in which the cicatrix of a wound from a sword was opened, and a large quantity of matter evacuated, the patient recovering. To a second, in which the patient was cured by an incision made on the seat of pain, and which patient he saw twenty-eight years afterwards. He mentions two operations of a similar kind, and followed by a successful result, performed by a Mr. Tucky on two soldiers in Dublin, under his direction. In a fifth case, in which it was attempted at a late period; the thickness of the pleura presented the completion of the operation. The external wound afterwards healed, but re-opened and discharged a considerable quantity of purulent matter. The body was not opened. In a sixth case, the opening was made an inch and a half below the cyst of the abscess, which contained eight ounces of purulent matter. "The rest of the lungs," Dr. Barry adds, "were sound. If the operation had been rightly directed he probably would have recovered." If the observation of Dr. Barry was correct, that the rest of the lung was sound, this was an abscess the consequence of inflammation, and such as I have said, I had seen sufficiently often, to establish the fact of their more frequent occurrence, in such cases, than had been supposed by modern pathologists.

The revival of this method by Dr. Hastings as a remedial one in phthisis has not yet been attended by any great amount of success. However, one of Sir H. Marsh's cases, published in Dr. Hastings' volume on the Use of Naphtha, recovered, and was in excellent health some years afterwards. When a large cavity exists in the lungs, we are told that it is generally accompanied by smaller ones, as well as miliary granulations; hence, if the operation is to be successful, the latter conditions must be remediable by internal medicines; and in Dr. Hastings' work, (page 181) a case is given, which although not treated by himself, was put under the influence of naphtha, the patient dying from accident whilst under treatment; after death a number of tuberculous cicatrices were found in the lungs. Should such cases as the foregoing now and then occur, they will go far, Dr. Hastings thinks, to justify a more complete trial of this operation.

*Pneumo-thorax*, as a medical disease, means an effusion of air and of the matter of a tubercular abscess from a diseased lung into the cavity of the chest. It exists as a surgical disease when the chest is distended with air issuing from a wound in a sound lung; in other terms, it is emphysema of the chest. In the first instance it is the end of a disease—in the second, it is the beginning. A third kind may however occur as a surgical disease, in which it does not take place in the commencement, but follows after the lapse of a few days. It is then pneumo-thorax from an ulcerated opening, the consequence of an injury in an otherwise *sound* lung, and from which the patient may hope to recover. The essential difference between the first and the third kind is, that the lung in the first case is diseased.

This complaint, although frequently mentioned by the older authors, was never distinguished in an especial manner, until it was named pneumo-thorax by Itard, in 1803. It has been supposed that the air escaping through the bronchial tubes opening into the tubercular abscess must eventually excite inflammation of the pleura. It is, however, probable, that as air in emphysema does not always give rise to inflammation, it may not be the air, but the irritation caused by the rupture of the tubercle, and the diffusion of its contents, to which it owes its origin. Inflammation once excited in this way, is followed by the effusion of a turbid, serous fluid, which ultimately becomes purulent, and by the formation of adventitious membranes, as in ordinary cases of pleuro-pneumonia, if the patient should survive the mischief long enough. The air which escapes into the cavity of the chest differs little from that which has been inspired, and usually occupies a much larger space than the fluid by which it is accompanied. When pneumo-thorax is the consequence of disease of long standing, the patient may be sensible of a sudden pain, which does not abate, and which is accompanied by an equally sudden increase of the difficulty of breathing, for which he cannot account. He feels relief by lying on his back, or on the affected side, rarely on the other, although the difficulty of breathing may increase, so as to render the further continuance of life doubtful, whilst the prostration of strength is considerable. The muscles of respiration are all in rapid and powerful action, the heart is displaced to the right side, when the complaint attacks the left; and it will be displaced somewhat to the left when the right is affected; in some cases it even descends into the epigastrium, or is otherwise removed from its natural situation, even towards the axilla, although the left side is supposed to be more obnoxious to this complaint than the right. The pulse becomes exceedingly quick and small, countenance pale, nights sleepless. The affected side is oftentimes evidently dilated, and the intercostal spaces may be less marked, or partly filled up, when the respiratory motion given to the parts under ordinary circumstances is seen to be deficient. But these differences, as well as that which can be obtained by comparing both sides by measurement, are not so marked as when the cavity is filled by fluid.

The discrimination of the disease will be assisted by *Succussion*, or shaking, which, when effected by an assistant, may shew that fluid is effused, but not air; also by *Percussion* beginning from above, which, in the erect position, will give, in cases in which it is ascertained that respiration is null, a clear tympanitic sound, as low as the level of the fluid, when it changes abruptly to a dull sound, or that indicating its presence If the patient be then placed in the recumbent position, the clear sound can be heard above, the dull one below, demonstrating the change in the situation of the air and of the fluid. An œdematous swelling of the side or back is by no means a common symptom when air alone is effused. Auscultation, in addition to the absence of respiration, when the chest is fully expanded, discovers no respiratory murmur; but a peculiar sound called by Laennec *tintement metallique*, or metallic tinkling, is heard at intervals, particularly on the patient's coughing, speaking, or breathing. It is imitated by dropping a pin into a large wine glass. It, however, more nearly resembles the sound of a jew's harp in the hands of a child, and once heard cannot be mistaken. When this tintement becomes plainer and deeper in tone, it was called by Laennec "bourdonnement amphorique," because it resembles the sound produced by blowing into a decanter or large bottle, and is supposed to indicate the enlargement of the fistulous opening in the lung. The metallic tinkling is then a distinctive sound of pneumo-thorax. At all events, it is so in surgical cases.

The first operation of puncturing the thorax for the evacuation of air alone, was performed by Mr. Kelly, of Leith, under the direction of Dr. Monro, sen., who had assisted Professor Meckel, of Berlin, in opening the body of a young soldier who had so extensive a pneumo-thorax, that it had depressed the diaphragm so much as to cause the liver to descend into the pelvis; this led to the first idea in his mind of an operation for the evacuation of the effused air. Mr. Kelly's case was successful, and is related, with the case of Professor Meckel, by Sir A. Halliday, in his work on Emphysema.

CASE 25.—A soldier was sent home invalided from the West Indies, for hœmoptysis, *which had succeeded a severe fall on the left side of the chest, received eighteen months previously.* He was admitted into the Military Hospital of Chatham, on the 9th May, 1823. On the morning of the 13th, after a violent fit of coughing, symptoms of pneumo-thorax came on suddenly, and continued increasing till the 21st. "The most prominent of these symptoms were (to quote the words of Dr. Davy) a feeling of extreme tightness about the chest and abdomen—rapid and difficult inspirations, between thirty and forty in the minute—great anxiety of countenance and agitation of mind, accompanied by a small pulse of 130—cold sweats frequently breaking out on the neck and face—considerable prostration of strength. On examining the chest, *the left side was found more protuberant, and in all its dimensions larger, than the right;* it was tense, and, on percussion, sounded remarkably hollow and tympanitic, giving the idea of its being distended with air. The heart was found beating under the right mamilla." Under these circumstances, it was resolved, in consultation, to tap the chest, which was accordingly done in the following manner: A trocar and canula were attached to an empty bladder, and the parietes of the chest punctured between the eighth and ninth ribs, the integuments and intercostal muscles having been previously divided with a scalpel. A little air only rushed out, and as it was concluded, from the persistence of the symptoms, that its escape was prevented by adhesions of the pleura at the point which had been perforated, the operation was repeated next day. The puncture was then made just below the left nipple, and, on withdrawing the stilet into the bladder, a large quantity of air rushed out and distended it. The bladder was then separated. Air continued to rush from the chest for several seconds, "as if from a blow-pipe." When this ceased, and when the air began to pass inwards during inspiration, the canula was withdrawn, and the wound healed. The relief to the patient was sudden and great, and he continued to improve till the 17th of June, when the account closed. No farther history of the case appears to have been published. The heart was still felt beating in the right side, and "the fluctuation of a fluid was perceptible in the left."—Dr. Davy, in *Philosophical Transactions*, p. 1823.

CASE 26.—From Dr. Johnson's *Medico-Chirurgical Review*, vol. 10, page 478. Mr. Cornish, a medical practitioner, having suffered an attack of pleuritis was attended by Dr. Johnson and Mr. Cooke from the 16th to the 21st December, 1828, when Dr. Johnson was satisfied of the existence of pneumo-thorax. On Monday, the 29th December, Mr. Cornish nearly expired from suffocation. He was lying on his right side breathing most laboriously, countenance sunk, pulse between 130 and 140; he had had no sleep for many nights. The action of all the respiratory muscles was painful to behold; no perceptible difference in the size or shape of the two sides. The *right* emitted an extremely dull sound, the *left* sounded hollow throughout. The apex of the heart was beating rather to the right of the right nipple. The respiration was loud and rattling in the *right* lung, metallic tinkling distinct in the *left*, expectoration muco-purulent, with specks of blood, and many black particles. In the evening Mr. Guthrie made a short incision on the lateral part of the left side between the sixth and seventh ribs, and cautiously opened the pleura, when a rush of air issued forth with a hissing noise, and strong enough to have extinguished several candles. The patient turned on his back, breathed with comparative freedom, and expressed his gratitude for the operation. No fluid issued from the wound when made a dependent opening. A piece of linen was placed on the orifice. On Wednesday the 31st, the difficulty of breathing returned, the wound having closed, the metallic tinkling had returned, and that side of the chest was as sonorous as ever. The wound was re-opened and enlarged, the pulse fell to 120, the metallic tinkling ceased to be heard, the patient took nourishment and an opiate at night, the air being evacuated from the chest by introducing a probe.

Jan. 1st, 1829, has slept several hours, breathing easy, pulse reduced in frequency, appetite good. A canula was placed in the wound, when large quantities of air came through it on each expiration; the heart beat two inches nearer the central line of the thorax than before. In the night he became greatly oppressed, and died next day. On raising the sternum the heart was found rather to the right of the median line of the chest. The left lung was collapsed to one fifth of its natural dimensions. The vacant space was filled with air, and about fourteen ounces of turbid serous fluid. The pleuræ costalis and pulmonalis presented marks of inflammation of a few weeks standing, viz., some thin false membranes which were easily separated by scraping with the scalpel. There were no marks of more recent pleurisy, even in the vicinity of the wound, there being only a slight ecchymosis between the pleura and subjacent cellular tissue, for the space of a few lines around the incision. A tube was inserted into the trachea, and air blown into the lungs. The left lung expanded to a certain extent, and air was heard to bubble out. The lung was then carefully removed, and an aperture was immediately recognized at the division, or cleft between the two lobes. The tube was inserted into the bronchus leading to the left lung, and Dr. Johnson blew in air. It rushed forth at the aperture, and extinguished a taper that was held near it. The aperture itself was then more accurately ascertained. It was circular, and capable of admitting a crow quill. It was evidently fistulous, and of several weeks' standing. It was found to communicate with a very small excavation, formed by the softening down of some tuberculous matter, and into this small excavation a bronchial tube was seen to enter. Thus the communication between the trachea and the cavity of the chest was distinctly traced through a bronchial ramification, a very small tubercular excavation situated on the very surface of the lung, and an aperture through the pleura pulmonalis. The left lung presented some trifling tuberculation, but was not materially diseased. The right lung was much more tuberculated; but the tubercles were principally in a quiescent state. There was no other disease in the chest. The tuberculation of the lung was of old standing, and the softening down of the tuberculous matter must have preceded the formation of the opening, and the escape of the air into the cavity of the pleura.

Case 27. By Dr. F. Bird.—William Layard was sent by Mr. Guthrie into the Westminster Hospital in August, 1842, with pneumonia, from which he recovered, but suffering a relapse, was re-admitted under Dr. Roe in September. On the 20th of October he was evidently labouring under the disease called pneumo-thorax of which the following were the symptoms:—He lay on his back breathing with difficulty, the left side being evidently fuller and rounder than the right, the interstices between the ribs being less observable, or more filled up than on the opposite side. The pulsation of the heart could not be felt in its usual place, but was distinguishable to the right of the sternum. The integuments of the chest were so œdematous on the side affected as to constitute a prominent symptom. On percussion the sound of the fore part of the chest was quite sonorous, like an empty cask, whilst that of the opposite or sound side was dull, and as the percussion was continued down towards the back, the sound also became dull, like that emitted from a full cask. No respiratory murmur could be heard on the anterior part or side affected, but metallic tinkling was distinctly audible within. On the 21st Dr. Bird punctured the left side with a very small trocar, and drew off forty-two ounces of a whey coloured serous fluid, a considerable quantity of air escaping through the canula with a very audible sound. The man was immediately relieved. The next day, the 22nd, he introduced a large trocar through the same opening, and drew off seven ounces of a fluid more turbid than the first, and on the 24th the discharge was purulent. The heart returned to its natural position, and some hopes were entertained of recovery, which were not verified, as on the 6th of November he died. On dissection the left lung was seen to be shrunk and lying close to the spine; air on inflation passed out particularly from two openings on its anterior surface, one the size of half-a-crown. The pleura costalis was coated with fibrin, as well as the pleura pulmonalis. The left lung was full of tubercles, many in a state of suppuration; the right was tubercular, and there was one abscess at the upper, and some purulent matter in the under part of the cavity of that side.

Case 28.—Mr. Stapleton, now Lord Beaumont, was wounded by a pistol ball on the 13th of February, 1832, when standing sideways; it entered the right side of the chest a little below the nipple, appeared to pass under the lower end of the sternum, just above or about the xyphoid cartilage, and to have lodged in the cartilage of the last of the true ribs of the left side, near its junction with the bone, in consequence of a round projection at that part resembling a pistol ball, but which, on being exposed, showed only a knob of cartilage which might have been a natural formation; no further steps were therefore taken. The injury had been received about four o'clock, it was now five; he could lay flat on his back, had little or no pain, or oppression.—Seven o'clock: Breathing became oppressed, and accompanied by pain; vesicular murmur distinct in both lungs; pulse 96. V.S. ad ℥xxxii.—Nine o'clock: Difficulty of breathing and pain greater; was again bled until the pulse failed, although he did not faint; the relief great.—Half-past ten: Oppressive breathing again returned, pulse very low and quick; thirty-six leeches applied, relief obtained.—Half-past twelve: Thirty-six more leeches.—Half-past two: Thirty leeches were again applied; in all four pints of blood were taken from the arm, and one-hundred and two leeches were applied to the chest, the bleeding being encouraged afterwards; during the first ten hours five grains of calomel and four of the compound extract of colocynth had been given, and now forty minims of Batley's solution of opium were administered.—Feb. 14, 8 o'clock: Slept after four o'clock; on waking took an aperient draught, and is much easier; pulse 120, soft, small, and weak.—3 p.m: On the dyspnœa returning twenty-one leeches were applied, and the oppression was relieved; felt sick, with a desire to vomit; Haustus effervescens.—5 p.m.: Easier, but faint and restless; bowels not open; an enema given, which acted freely.—Half-past 12: A returning oppression relieved by eleven leeches; calomel repeated, and sol opii. m. xxx.

Feb. 15, 8 a.m.: Night restless, but slept at intervals; slight tickling cough; little or no expectoration, no blood; faintings less, but thinks he would faint if he sat up in bed; pulse 130, soft, small, and weak; little pain; lies tolerably flat; respiratory murmur appears tolerably distinct on both sides.—9 p.m.: Oppression returned; twenty-four leeches; Repeat calomel and colocynth, to be followed by an enema, after which the bowels became free; the sickness, faintness, cough, &c., continued all day.—Vespere: calomel gr. vj. haustus Opii.

Feb. 16, 8 a.m.: Had forty-eight leeches applied at twice during the night; they have just ceased to bleed; has slept at intervals, and is easier; has no pain in the chest; pulse 108.—Vespere: Is improved; an enema statim; afterwards, calomel gr. vj. opii. gr. j.

Feb. 17, 8 a.m.: Slept fairly during the night, and is better; pulse 108, soft; breathes freely, and has no pain.—Vespere: Has had leeches applied twice during the day, making in all 245, and each time with relief; an enema, calomel and opium as before.—12 at night: More oppression, and as the pulse was fuller and quicker, a vein in the arm was opened, but only four ounces of blood could be obtained.

Feb. 18, 8 a.m.: Slept at intervals, although very restless; pulse 120, fuller; oppression in breathing returning; V.S. ad ℥xx., which caused him to faint; Haustus sennæ.—Vespere: Has been much relieved by the bleeding; blood cupped and buffy; twenty leeches; enema as before, calomel and opium.—In the night, at 2 o'clock, the dyspnœa returning, twenty-two leeches were applied, and thirty minims of sol. opii. given.

Feb. 19, 8 a.m.: Easier, quieter, better; pulse 110, soft; can lie quite flat on his back. The wound discharged so little, that it was possible the matter had not a free passage; the external parts were therefore dilated inwards towards the sternum, until the pulsation of an artery could be seen, perhaps the internal mammary, which it was not thought advisable to disturb; respiratory murmur not distinct at night; enema as before, calomel and opium, and twenty leeches.

Feb. 20: During the night, or at three in the morning, being greatly oppressed, thirty leeches were applied, and at eight o'clock twenty more, which quite relieved, but left him in a state of great exhaustion, sick and faint. A little arrow-root relieved the faintness; discharge from the wound free and accompanied by *air;* bowels open.—10 at night: calomel, and forty minims of the solution of opium.

Feb. 21, 8 a.m.: Says he feels better, and now for the first time has a hope of life: pulse 112, soft, no pain, can turn on his side, but fears to hurt himself; wound discharges freely; has had a small piece of bread for the first time.—4 p.m.: restless but better; haustus sennæ c. mag. sulph.—8. p.m.: Oppressed; pulse 120: twelve leeches; calomel, and sol. opii. m. xxx. h. s.

Feb. 22: Better; pulse 115, soft; Dr. James Johnson and Dr. Elliotson examined the chest, and satisfied themselves that no serous effusion had taken place, and that the lungs were respiring fairly: calomel and opium at night.

Feb. 23: Oppression at night relieved by six leeches; slept afterwards; breath slightly affected by the mercury, which was now omitted; the compound extract of colocynth, gr. x. given at night, with thirty minims of solut. opii.

Feb. 25: Free from pain; breathes easily and without difficulty; can turn in bed with ease; slept well; the discharge from the wound is free; takes farinaceous food, oranges, tea, &c. He gradually improved until the 13th of March. On the previous Friday, the 9th, he removed from Long's Hotel, in Bond-street, to 125, Mount-street, and on the 13th amused himself by washing all over in a third or small back room without a fire; caught cold, and acquired a troublesome cough, which was quieted on the 14th, at night, by opium. On the 15th, a.m., it was evident that some mischief had been done; pulse 120; breathing difficult; was bedewed with a cold sweat; respiratory murmur indistinct on both sides; on the left not heard below the fourth rib; although the whole side sounded sonorously, it evidently contained air, the tintement metallique being very remarkable, on which account he was again seen by Drs. J. Johnson and Elliotson in the afternoon, who thought the pneumothorax of the left side complete both as to air and to a fluid effused. The wound having closed very much, and the distance to the left cavity of the pleura under the sternum being considerable, it occurred to me that a piece of sponge tied around the eye of a small gum elastic catheter in a proper manner, might be introduced, so as to enlarge the track of the ball, and give passage to the air from the left side of the chest. This was done at five o'clock p.m., and at ten, on its being withdrawn, air rushed out in a very manifest manner, and to his great relief. The metallic sound which was distinct before the instrument was withdrawn instantly ceased, but could be reproduced by closing the opening. The small gum catheter was therefore re-introduced with the eye projecting beyond the sponge, and retained, air passing through it; cough very troublesome.

March 16: Quieter, breathes more easily; cough troublesome; expectorates a little mucus; bowels confined; calomel and colocynth at night; mist. amygdal. c. antim. tart.

March 17: Better, pulse 100; bowels open; cough easier; expectorates freely a *rouillée*, or reddish muco-purulent matter.

March 18: Easier and better; breathing on the left side not heard below the fourth rib; discharge free; the permanent gum catheter taken out, but passed in daily.

March 24: Continues to improve; wound gradually closing. After this he slowly but regularly became convalescent, so as to render further reports unnecessary.

The case of Lord Beaumont is given at length, it being a remarkable instance of the strict and constant watching such cases require. He is now at the end of fifteen years in perfect health, and feels no inconvenience from the injury. Respiration is perfect on the left side even at what must have been the part injured, and there is no reason to believe from auscultation that the lung adheres by its pleura to the wall of the chest.

Dr. Houghton, in his able article on pneumothorax, in the *Cyclopædia of Practical Medicine*, declares the opinion to be unfounded which supposes that the presence of compressed air is necessary for the production of metallic tinkling. The great point to overcome is not, however, the opinion, but the fact, that the evacuation of the air destroys the sound, and that the restoration of compressed air re-induces it. If the fact is not so, the opinion is, of course, good for nothing; but if the fact is admitted, I am indisposed to consider Dr. Houghton's objections valid. He advances two special instances, amongst other general ones, in support of his objection. The first is, that when drink is taken into a flatulent stomach, a metallic tinkling may be sometimes heard, on coughing or speaking, and he concludes that the air is not compressed in a flatulent stomach, a conclusion I am not willing to admit; for, although the air might like to have it all its own way, and to distend the stomach, and stretch the wall of the belly as much as it pleased, these two living parts may not like the stretching, and in turn may try to compress the air, which, in fact, I believe they do; hence the metallic tinkling. That a metallic tinkling is heard on auscultation, immediately after the fluid has been drawn off by the operation for empyema, I do not suspect to be the case, but that it may be heard perhaps after some time, when the fluid again secreted has encroached upon, and compressed the air which replaced the fluid withdrawn, I do not doubt. The objection thus raised actually supports my hypothesis, which I value as nothing, beyond the fact, that with the evacuation of the air the metallic sound for the time ceases.

That an operation for the removal of the compressed air should only be palliative, when the disease has been caused by a tubercular abscess, cannot be doubted; more could not well be expected from it.* That the complaint is permanently removable—when the lung is only accidentally, and not constitutionally, diseased,—the case of Lord Beaumont is a brilliant example. There is neither difficulty nor danger in such cases, in introducing a small trocar and canula for the evacuation of the air; and if nothing should pass out, the little air which may pass in will soon be absorbed. In Lord Beaumont's case, the air certainly passed out, and, in all probability, passed in through the retained catheter, and it assuredly did no mischief. If I had not succeeded in his case with the sponge tent, I was prepared with a small trocar and canula, through which I should have passed the elastic catheter; a practice to be pursued in other cases which may be similar, this being, certainly at that time if not at present, the only instance of a case of pneumo-thorax from a gun shot wound of the lung terminating favourably, in consequence of the surgical evacuation of the compressing air.

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* See the Review in the EDINBURGH MEDICAL JOURNAL, for January, 1848, of the works of Messrs. Addison, Bourgery, Rainey, &c., on the Anatomy of the Lung, and particularly of the Air Passages.

# LECTURE VII.

*Emphysema; Cases by Paré, Wiseman, Littre and Dr. W. Hunter; Emphysema of the Lung; Character and Causes; Symptoms of Emphysema; Emphysema caused by Fractured Ribs; Treatment; By Punctures; Mr. J. Bell on Emphysema; Baron Larrey's Cases; Mr. Guthrie's Case; Emphysema never caused by a Musket-shot Wound; Condition of the Lungs in Emphysema; Treatment of Extreme Cases; Hernia of the Lung; Sabatier's Case; Cruveilheir's Opinion that Hernia of the Lung may be mistaken for Circumscribed Empyema; M. Jobert's Case; M. Cruveilhier's Case of Old Hernia of the Lung; M. Lavallée's Cases and Opinion;* Wounds of the Heart; *their Fatality; Opinions of the Ancients that Wounds penetrating the Cavities of the Heart were immediately fatal, but not so, if the substance only were divided; Cases of Foreign Bodies found in the Hearts of Animals; Mr. Grainger's Case; Cases of Wounds of the Heart from various Authors, in which the Injury was survived during a longer or shorter period; Senac's Opinion that Wounds of the Right Ventricle are more common and more quickly fatal than those of the Left; Cases of Wounds of the Heart recorded by Dr. Babington, Mr. Featherston, M. Ferus, Messrs. Davis and Steward, M. Fournier, and Mr. Trigge.*

Emphysema, from εν in and φυσαω to inflate, the diffusion of air into a part of, or throughout the cellular tissue of the body. The term has been applied of late to such diffusion taking place from an injury to the lung; it is then called *traumatic.* When it occurs otherwise, it is said to be, *idiopathic,* or *spontaneous.*

Case 29.—Paré (Libr. viii., chap. xxx., p. 91) says, that a man, named François Brège, was wounded at Joinville, on the 1st of May, 1574, by a sword, which divided a part of the trachea, and one of the jugular veins. The wound having been sewn up, the wind introduced itself into the cellular membrane, and blew him up like a sheep, prepared by inflation, for skinning. Under these circumstances, M. Le Jeune, Surgeon to the Duke of Guise, thought it right to have recourse to the extreme remedy of making several deep scarifications into the swollen parts, after which F. Brège recovered.

This observation of Paré seems to have passed without notice by subsequent writers.

Case 30.—Wiseman, in the folio edition of his works, published in London, in 1705, says, Obs. 4. "A footman was wounded in the left side, and coughed up and discharged much blood by the wound. Some days afterwards, feeling a crackling about the wound with my fingers, and concluding it was air which had got out of the thorax, I made an incision into it, about an inch long, and discharged it."

Wiseman does not seem to have been aware that he was doing anything out of the ordinary mode of proceeding in such cases.

Case 31.—Littre, in his Memoir on emphysema in the *Histoire de l'Academie Royale des Sciences,* for 1713, says, that a man thirty years of age, died five days after he had received a wound in the chest from a sword. The emphysematous swelling was eleven inches thick on the chest, nine on the abdomen, six on the neck, and four in other parts of the body. The very eyelids, he says, were distended like balloons. On opening the chest, he found about eight ounces of blood mixed with pus. The sword had penetrated one of the three lobes of the lung, which was hard and blackish; the wound in it was open, seven or eight lines in width, and one and a half in depth. The other lobes were a little inflamed; the external wound was closed, but that in the intercostal muscles and pleura had not united.

He was bled, Littre says, six or seven times, but there can be little doubt that nothing essential was done for his relief. Mery, in relating another case in the same volume, expressly says, that if he had made an opening in the skin, he might have relieved the emphysema, but his patient would have died notwithstanding. These two French writers seem to have been unacquainted with the practice of Paré and of Wiseman, although they have themselves been usually referred to as perhaps the earliest authorities on the subject of emphysema, by subsequent writers.

Case 32.—Dr. W. Hunter gives the following account of a severe case in the second volume of the *Medical Observations and Inquiries,* page 17, for October, 1752:—The patient was in bed twenty-nine hours after the accident, a fall from his horse, injuring the side; panting for breath; his form that of a human skin stuffed. The inflation was great and universal, except in the (palms) of the hands, and (soles) of the feet; the skin was everywhere shining. The air could easily be pressed out of any part, but it returned. When struck, his body sounded like a wet drum; and when pressed, the air could be felt, and its sound distinctly heard. Those parts on the surface which have a more loose and yielding cellular membrane were proportionably more swelled. The eyelids, penis, and scrotum, were as much distended as in the worst case of anasarca. The breathing was laborious; the inspiration so short, as to be almost instantaneous, ending with that catch in the throat, which is produced by shutting the glottis; after this he strained to expire without any noise; then suddenly opening the glottis, he forced out his breath with a sort of inward groan, and in a hurry, and then quickly inspired again, so that his endeavour seemed to be to keep his lungs always full. Inspiration succeeded expiration as fast as possible. From the small quantity that was inspired and expired at a time, it was plain that he either had not room for a greater quantity, or could not bear a greater expansion of the chest. Neither Dr. Hunter nor Mr. Cheston, who related a somewhat similar case in the same volume, referred to the labours of their countryman, Wiseman, although they noticed those of Littre and of Mery.

Emphysema has been said to take place after a wound in the chest, but without an injury of the lung, from the air passing through the wound into the cavity during inspiration, and by accumulation and subsequent compression under the act of expiration, giving rise to all the symptoms of the disease. I have never seen such a case, and have a suspicion that the complaint is more theoretical than real, although thought deserving by Messrs. Halliday, S. Cooper, and others, of an especial paragraph.

Emphysema of the lung, as a medical disease, is mainly opposed to the ordinary emphysema or surgical disease, in not being an extravasation of the air into the cavity of the chest, but a dilatation of the air cells formed for its reception. It is of two kinds, *Vesicular* and *Interlobular*—vesicular when dependent on the enlargement of one or more air cells; interlobular when, from the sudden rupture of an air cell, the air has found its way into the interlobular structure of the lung. A third and very rare kind has been added, in which air being extravasated under the pleura, has raised it in the form of a pouch. The morbid appearances these diseases afford, and the symptoms they give rise to, I shall not notice, as they do not fall within the range of surgical skill, and not frequently within the controlling power of medical ability and science. The vesicular emphysema has been commented upon by Valsalva, Morgagni, Ruysch, and Baillie, and it has been particularly described and explained by Laennec, to whom our knowledge of these complaints is principally due.

They are usually complaints of some standing before they are discovered, and are accompanied by other diseases of the lungs, principally by chronic catarrh, asthma, &c. The interlobular is sometimes formed suddenly from the rupture of one or more air vesicles; is more apparent by irregular elevations on the surface of the lung; and when the rupture occurs near its root, the air may penetrate the mediastinum, and be propelled from it into the subcutaneous tissue of the neck, and even of the whole body. Instances are on record of its occurrence in this manner after severe coughing, great straining in labour, &c. &c., when it is possible that the air may require to be allowed to escape through punctures made in proper places for the purpose. Air is said to be secreted in various tissues of the body during life, and to become even combustible; it is probable that in such cases it results from the commencement of putrefaction before death. The small ubiquities of emphysema, such as blowing up the cellular membrane covering the lachrymal passages, or frontal sinuses, are curiosities.

Emphysema being a swelling commencing for the most part suddenly, is free from redness, and is distinguished from œdema, or the swelling containing a serous fluid which is also colourless, by its not pitting on pressure or retaining the mark of the finger. It is on the contrary elastic, and the displacement of the air, on pressing on the part, gives rise to a peculiar noise, resembling the crackling of a dry bladder partly filled with air, on its being compressed, usually called crepitation. This swelling extends as the air introduced into the cellular membrane increases in quantity, until the whole body may be distended in the way described in the foregoing cases.

Emphysema most commonly occurs from fractured ribs, a point from one or more of which abrades the surface of the lung. Through the opening thus made, the air escapes into the sac of the pleura, and thence by the side of the broken part of the ribs into the cellular membrane. The distress in breathing arises from the air being diffused over the surface of the lung, which it gradually causes to collapse under the pressure exercised by the act of expiration, whilst at the same time the mediastinum yielding, the opposite lung suffers in a similar way, although to a less extent, until the aërification of the blood is so greatly obstructed as at last to interfere with life, unless relief be obtained by equalising the pressure made on the lung by the compressed air in the cavity of the pleura, with that exercised on the inside of the lung through the glottis.

In ordinary, but not severe, cases of fractured ribs, a slight degree of emphysema is frequently observed over the injured part, implying that the lung has been abraded or otherwise injured; such a case rarely requires more than the application of a compress wetted with a little spirit and cold water retained by a bandage. The great art in the treatment of broken ribs by compress and bandage, consists in their proper application, and this can only be ascertained by the feelings of the patient. The application of a broad flannel bandage, so as to restrain the motions of the chest, and to cause the sufferer to breathe by the diaphragm, has been recommended from the earliest periods of surgery. It is, however, a recommendation frequently more honored in the breach than the observance. Many persons with injured or broken ribs cannot bear the pressure of a bandage, whilst others derive much ease from its use. It is then a point to be ascertained from actual experiment, and as far as observation goes, I am induced to say that a tight bandage generally disagrees when the injury has been sustained at the lower part of the chest, and is more frequently useful above the fifth or sixth rib.

When the emphysematous swelling extends so as to invade a considerable portion of the body, the further diffusion of air should be prevented by punctures made through the skin in such places as may be thought necessary, and in extreme cases even by incisions; but these are things more often spoken and written about than practised, or than are even necessary.

Mr. J. Bell had so alarmed all military surgeons by stating, in his able discourses of the nature and cure of wounds, that emphysema was "peculiarly frequent in gun shot wounds of the chest, both at the orifice of entrance and of exit of the ball," that they thought of little else. They could not withstand the brilliant manner in which this remarkable error was expressed. It carried conviction with it, and Dr. Hennen says, it actually haunted his hours of repose, when he first entered on the practice of military surgery. To such of us as had served the first part of the war in Portugal, it was no longer a bugbear; we slept in peace after the battles of Roliça and Vimiera, of Corunna, of Oporto, and Talavera—laughing perhaps a little at the credulity of the surgical portion of mankind. We had not time to do more in those days than to prepare our materials for a future occasion, and to instruct our brethren who joined us on the field of battle in the errors they had to unlearn; I have shewn, page 4 of my Record of Wounds of Arteries, that the alarm was even entertained at home as late as the battle of Waterloo, and the opportunity of seeing such cases was sought after with avidity by the learned professors of the day, who could not find them at home, and were not less disappointed abroad.

Baron Larrey, writing in 1829, is not less eloquent and alarming than Mr. J. Bell: he does not, however, say that emphysema is of common occurrence after gun-shot wounds, but that it does occur after punctured or other small wounds into the cavity of the chest; and I have transcribed from Vol. II., page 188, *et seq.* the two following cases—premising that the Baron not only writes forcibly, but occasionally somewhat *(tant soit peu)* exaggeratively.

CASE 33.—A Polish officer was wounded by a lance in 1812, at the inferior angle of the left shoulder-blade in an oblique direction, which penetrated the cavity of the chest. The edges of the external wound were brought and retained in contact by compress and bandage. Twenty-four hours afterwards the Baron found his whole body distended by air to the highest possible degree above alluded to. Respiration and pulse scarcely distinguishable. He removed the bandages and enlarged the wound, so as to make a clear passage from the chest outwards; the edges of the wound were dry cupped, and afterwards simply brought together and covered by a piece of linen wetted with camphorated wine. Air was drawn from various parts by cupping-glasses, and principally on the chest and extremities. Frictions with ammoniacal and camphorated wine were resorted to frequently. When scarificators and glasses could not be applied, punctures were made, and an infusion of arnica montana given for drink. He gradually recovered.

CASE 34.—A soldier was wounded on the 27th Jan., 1818, in the right arm-pit, by a foil, the button of which had been removed and the point sharpened; it passed under the muscles, and penetrated the cavity of the chest, between the fourth and fifth ribs near the sternum. Very little blood was lost, but emphysema rapidly took place, so as to distend the whole of the cellular membrane of the body in so remarkable a manner, as to render it an enormous and apparently shapeless mass. A good and sufficient compression was made over the opening into the cavity of the chest to prevent the further exit of air from it; an incision was made over the trachea, a second below the sternum, and a third on the left side of the chest. On these, cupping-glasses were applied with great effect; the swelling gradually subsided, and by a repetition of them and other ordinary means, the air was entirely removed, and the man gradually recovered."

CASE 35.—A soldier was brought to me after the battle of Albuhera, who had been wounded in the right side of the chest by a sword, which had passed slantingly under the shoulder-blade, from which injury he did not suffer much, until the whole side, as well as the body and neck, began to swell, and impede his breathing, which was effected with some difficulty, and only with any ease when sitting up. The case being plain, I enlarged the external wound, until I could distinctly hear the air rush out, and see the part where the weapon had penetrated between the ribs; upon which he declared himself relieved. After a short time, when it was supposed that the pressure of the air within and without the lung was equalised, the wound was closed by compress and bandage. It did not, however, unite; active inflammation of the cavity of the chest ensued, requiring frequent and considerable losses of blood for its domination. It at last became quiescent, and at the end of three weeks the man was sent to Elvas, in a favourable state for recovery.

I have seen some others of a similar nature, but never one more important with relation to the emphysema.

The large opening made by a musket-ball never admits of emphysema to a troublesome extent; and, in fact, it rarely takes place at all. A slanting wound made by a small pistol-shot may give rise to it, but it seldom does so. It commonly succeeds long and tortuous wounds, made by swords, lances, or bayonets; and then only shortly after the occurrence of the accident.

I have said that when an opening is made into the cavity of the chest in the dead body, the lung gradually recedes from the pleura lining its wall, for some distance; it is said to collapse; but this does not take place to anything like the same extent in the living body; and if the continued admission of air through the wound is prevented, it scarcely takes place at all: or, should it have done so, the air is usually absorbed, and the lung quickly recovers its natural dimensions and functions. Neither does a wound in the chest, when kept open, usually cause this collapse to the extent, which it is generally supposed to do in the living body. The lung can be seen in motion, and performing its office, although imperfectly, as it does not fill the cavity of the pleura. When the lung is wounded by a ball actually going through its substance, it does not necessarily collapse; and abrasions, or deeper injuries of its surface, lead to no such results, as was evident to all the gentlemen who were present at the opening of the body of the late Mr. Drummond. To cause the collapse of a living lung, its surface must be compressed by a fluid, as in empyema, or by air, as in emphysema, or pneumo-thorax, when a wound in the lung does not, or cannot, be closed by the usual processes of nature for such purposes, and the orifices of the *bronchial tubes* communicating with the canal of the wound, instead of becoming closed, remain pervious, a misfortune which does not commonly occur. The air escaping into the cavity of the pleura at every inspiration, becomes more and more compressed at every expiration, and thus, at each time, a little more escapes, and is then compressed, until the lung becomes flattened towards the posterior mediastinum and the spine, but not impervious; for until the last a little air will pass into it on each attempt at forced inspiration, or the pumping, as it may be termed, which occurs previous to dissolution. It would appear that the mediastinum yields, and bulges into the opposite side; that the heart, with its pericardium, gives way in a similar manner; and that the elasticity and resiliency of the lung, aided by the pumping force employed, are only overcome by the resistance of the surrounding structures, which can yield no further, unless by tearing, which the muscular power giving rise to inspiration is incapable of effecting; or if it should occur in some rare cases, it only adds another evil to those already existing.

In these extreme cases, when the patient can no longer lie down, but sits up supported, in the greatest agony of respiration, approaching to suffocation, the face and lips swollen and blue, the pulse almost imperceptible and countless, Mr. Hewson recommended an opening to be made into the chest, for the purpose of evacuating the highly compressed and compressing air, and to allow the expansion of the lung after its evacuation. Bromfeild and B. Bell supported this opinion, which John Bell condemned. My excellent friend and colleague at the College of Surgeons, Mr. S. Cooper, in his *Surgical Dictionary*, supports John Bell, on the ground that " it is impracticable to make the collapsed viscus, or lung, expand, until the breach is closed;" an opinion in which he has been followed by most teachers of surgery in London, but which I nevertheless apprehend to be an error, for the air is not drained off through the wound in the lung, in the manner that water is drained off through a breach in a barrel, but it is squeezed out by the compressed air being more elastic, and exercising a greater compressing force than the expanding power of the lung, aided by the respiratory muscles. The lung is, therefore, flattened. When this compressed air is drawn off, through the canula of a small trocar, as was done in the case of Lord Beaumont, the compressing power being removed, the lung expands, in spite of the breach in it, and the mediastinum and heart return to their natural situation, the distress in breathing is removed, the failing circulation is restored, and the opposite lung resumes its functions.

The course then to pursue in such extreme cases is, to puncture the chest, evacuate the air, withdraw the canula, and close the opening. The life of the patient, having been thus saved, time is given for the wound in the lung to heal under the usual inflammatory processes, provided it will do so without a recurrence of the mischief, which, if it should take place, must be met by another puncture, or the opening in the chest should be made permanent, in order to equalise the pressure of the air in the cavity.

The incisions (" the taillades of the French") into the cavity of the chest formerly recommended, will not, I apprehend, be necessary, and should only be resorted to when the means indicated have failed, which they will rarely, or never do, when combined in the first instance with an antiphlogistic treatment, carried on as far as prudence dictates, aided by sedatives, and if necessary by cordials.

The advantages to be derived from percussion and auscultation in these cases are too prominent to require enforcing here. Their value has been sufficiently shewn in the preceding lectures, and they should be resorted to at every visit, or at least three times in the twenty-four hours.

*Hernia of the Lung,*—the consequence of an injury, is a complaint of rare occurrence. It appears to take place when a deficiency occurs in the intercostal muscles, and the parts under the skin do not become firmly consolidated.

Case 36.—Sabatier relates one case, occurring after the cicatrisation of an extensive wound, made between the fifth and sixth ribs by a bayonet, at the battle of Rosbach; the divided intercostal muscles did not reunite, he says, and the lung protruded the skin at each *inspiration*, and again retired at each *expiration*, with but little uneasiness to the patient.

M. Cruveilhier supposes, in his *Anatomie Pathologique*, that a hernia of the lung pointing externally, may be mistaken for a circumscribed empyema, formed after an injury, if one had been previously inflicted at that part, and the operation for empyema by necessity might be performed in error. M. Jobert had a case of empyema, in which when the patient *expired* strongly, a tumor appeared the size of a hen's egg, between the xyphoid cartilage, and the cartilaginous edge of the ribs; and when he coughed, the hand placed on it was raised, as if something displaced it. It might have been taken for a hernia, if the fluctuation had not been unequivocal, and the patient had not lately suffered from an attack of chronic pneumonia.

Case 37.—An examination of a hernia of the lung, in a man aged seventy-seven, occurred in 1832, at the hôpital St. Louis. M. Voisin, now of Limoges, gave the parts to Cruveilhier, who found that it had formed between the third and fourth ribs, after an injury from the pole of a carriage, which had broken both ribs in his youth. The ribs had separated, forming an oval opening, four inches in length transversely, and two and a half vertically. This opening was filled up by a herniary sac, extending from the pleura costalis, and lining the inside of the pectorales major and minor; but the pleura costalis was attached to the pleura pulmonalis around the part of the lung which protruded into the herniary sac, and which Cruveilhier thought must be a new formation. The protrusion was only observable on a deep inspiration, or on coughing, and gave no inconvenience. M. Morel Lavallée believes, according to Vidal, that the protrusion only takes place in such cases at the moment of expiration, when the swelling of the part and the crepitation can alone be felt. In a case related by M. Lavallée, before the Surgical Society of Paris, the hernia followed a sword wound, a little below and to the inside of the left nipple, and gave few, or no, distinguishable signs during inspiration ; but during coughing or blowing the signs of enlargement were very distinct. " On coughing, the part became as large as an egg, evidently proceeding from the inside of the chest, and giving to the finger the feeling of air penetrating the smaller air-cells, or that experienced on blowing into a lung retained between the fingers. The ear applied to the part during the expiration or cough, perceived an intense crepitation, less marked, however, than when examined by the touch, as well as a natural respiratory murmur when quiet, being however stronger, softer, and less veiled; exactly like the sound given out by a pulmonary lobule, inflated close to the ear, but without enlargement of the part."

I have seen but two undoubted cases of hernia of the lung after injury, and in these the elevation of the part or protrusion certainly took place during *expiration*; so that the remark of Sabatier was, in all probability, inaccurate.

*Wounds of the Heart* are for the most part immediately fatal. Many persons have however been known to live for hours, nay days, and even weeks, with wounds which could scarcely be otherwise than destructive; and several cases are recorded, in which the cicatrixes discovered after death, in persons known to have been wounded in the vicinity of the heart, have shewn that even severe wounds of that most important organ are not necessarily fatal. As our knowledge of the nature of the injury inflicted can never be distinct, it follows that every wound should be considered as curable, until it is unfortunately proved to be the contrary.

Hippocrates, sec. 6, aph. 18. Aristotle, lib. 3, part an. c. 4. Pliny, lib. xi. c. 69. Galen, in commentar. sec. 6, aph. 18. Paulus Ægineta, De Re Med. lib. vi. de telis, &c. Avicenna, lib. 4, tract 1 and 2, and Celsus, s. 8, lib. 5, c. 26, *De Re Medica*, believed that a wound of the heart which penetrated any of its cavities was quickly fatal; but that a person might survive twenty four hours, if the substance only were divided. Fernelius, who was a mere copyist of his great predecessors, re-asserts the same, lib. Παθολογ c. 12, but adds that he had seen three ulcers on the surface of the heart of a person, which must have existed for some time. In animals it was then known that perforations of the cavities were not always mortal wounds. Desiderius, Jacotins, Comment. Coac. Hippocrat, lib. 1, sec. 3. Thomas de Verga, Gaspard de Rejès, each give an instance of an arrow head being found in the heart of a stag, when killed long after the wound had been received, and of which the animal had recovered, and J. C. Weber of a ball lodged in the heart of a stag. Dolæus notices a nearly similar instance in his *Ephemerides*, 1667, p. 166. Brassavolus, comment. ad aph. 18, sec. 6, saw a hog live for an hour, and eat after receiving a wound of the heart. Felix Plater says he found a piece of wood in the heart of a healthy hog. Duverney is said by Peyer, *Parerga Anat. et Med. septem, &c., Geneve*, 1681, c. 16, Ephem. Nat. cur, Obs. 177, p. 166, to have found a rusty needle in the heart of a fat cow, and J. Lasserre, several small shot in the heart of a dog. J. Corn. Weber, Anchora Sauciatorum, &c. 1600—speaks of the case of a ball found in the heart of a boar, who had recovered from the wound; around it it had the material with which it was enveloped to make it fit the gun.

In later times Mr. Grainger, of Burton-on-Trent, mentions the fact of a deer having been killed in Bradby Park, when a ball was found contained in a cyst in the substance of the heart. One of the ribs bore the mark of having been fractured, and the heart and pericardium adhered to its inside at that part. *Edin. Med. and Surg. J.* vol. 12, 1816.

Cabrol, Observationes Anat. p. 26, is the first who says he found a cicatrix two fingers wide on the heart of a man who had been previously wounded. Idonis Wolf, Obs. Med. Chirurg. Quedlingburg, 1704, lib. 1, obs. 21; says, that in 1642, Tourby of Paris, found an extensive cicatrix near the apex of the heart of a man, known to have been wounded four years before.

Paré, in the 32nd chapter of his *Œuvres Completes*, edited by Malgaigne, Paris, 1840, has brought forward all that was known at his time by his predecessors, and particularly by Guy de Chauliac and Vigo. He was, however, the first to record a case of wound of the heart which was not instantly mortal; it occurred in the person of a gentleman at Turin, who, having received a sword-wound under the left breast, pursued his opponent for two hundred paces before he fell. A wound in the heart was found, capable of admitting the finger.

Morgagni, *De Sed. et Causis*, epist. 63, sec. 26, relates the case of a beggar, who having been stabbed through both sides of the left ventricle, walked seventy yards, sat down, and died half-an-hour afterwards, while throwing up his dinner.

Mr. Baird, in the *Monthly Journal of Medical Science*, relates the case of a man who walked one hundred and fifty yards, after receiving a wound of the left ventricle of the heart, before he died. The blade of the knife was half an inch wide at its point, and the wound in the heart was transverse, and after death half an inch in length. The pericardium contained only a small clot or two of blood, although three pints were found in the left cavity of the pleura.

Henry the IV. of France, the great friend of Paré, assassinated by Ravaillac, was twice struck by the poignard; the first blow did not penetrate the chest, the second traversed the left lung, and opened one of the pulmonary veins, entering the left auricle of the heart. The cavity of the chest was full of blood.

Lucius of Ingolstadt (In Bonet, Sepulch. Anat. t. iii. p. 358) says that a printer wounded through both ventricles, walked afterwards for some distance in the market-place before he fell dead. Henri de Heers, Obs. Med., lib. 1, obs. 2, relates the case of a man who lived two days after a wound of the ventricle, and of another who lived seven days after the heart had been wounded in two different places by two balls. Tulpius mentions one who lived two days after two stabs in the heart. Riva, one who lived four days with two wounds of the right ventricle. Furst and Zachias, at. 2, quest. 2, tom. 1, lib. 5, each the same. Bartholin, Hist. Anat. et Med., rar. cent, c. 1, Hist. 77, relates the case of a young man who walked home a considerable distance, and lived five days after having received a wound of the right ventricle. Meckren, obs. med. chir. 16, p. 153, the same. Garmanus, Ephem. Nat. cur. dec. 2 un 3, obs. 114, p. 228, one for six days. Caranius, Zodiac Med. Gall. in Bonet. loc. cit. p. 379, after a gunshot wound, seven days. De la Sue, in the *Academy of Sciences* for 1744, seven days. Rhodius, nine days. Bonetus, Loc. cit. p. 376, obs. 3, gives another from Le Roy, of a similar wound, in which the patient lived 23 days; and from Billy another, also fatal in five days. Mummius Luddens, of Tonningen, obs. 44, de la dissert. de M. Allewereildt, Theses de Paris, 1807, No. 73, saw a man who, having quite recovered from a wound of the heart, died suddenly of an abscess formed on its surface. Hildanus, Obs. Chir., says a man outlived a wound of the heart several months in great distress, and died at last suddenly, the heart and pericardium being found, on dissection, in a state of suppuration. Fantoni, in the *Giornale de Lit. d'Italia* loc. 21, p. 145, relates a case of a wound of the heart, which suppurated and discharged freely for twenty-three days before the man died; and of another who lived seventeen days after receiving a wound of the left ventricle, although he lost a pound of blood daily from it, none being afterwards found in the pericardium. In a case related by Panaroli, of Rome, in his Iatrologismorum, &c., 1643, the man lived four days, although the right ventricle had been transfixed in two places. Dolœus, in the *Ephemerides de la Nature*, had a case of wound of both ventricles, after which the man lived five hours. G. Horstius, Observat. Medicin. ad Hildan. Sur. &c. lib. i. obs. 18, speaks of a wound of the septum without implicating either cavity; the patient lived eight days. Weitzmann, Witteberg, 1775, of the apex of the heart who lived fourteen days.

La Motte in his 227*th Observation*, relates the case of a man whose chest was penetrated, on the left side, by a sword from behind, between the fifth and sixth ribs, and which came out in front, a little below the nipple; he lived two hours. The coronary artery was divided, and the left pleural cavity was full of blood. In his 228*th Observation*, the soldier died in twelve hours, the left side being full of blood, which escaped through an opening so small near the apex of the left ventricle, that many would scarcely believe it had been wounded. Bonetus relates another case, that of a nobleman, who lived three days after having been stabbed in the right axilla between the third and fourth ribs. The lung and pulmonary artery were both wounded, and the cavity of the same side of the chest was full of blood. (See Timæus, xvi in Boneti sepulchretum, vol. iii, p. 359, and casus med. prax. &c., Leipzig, 1667.) Helwig. Obs. Med. phys. Augsbourg, 1680., the case of a man run through both ventricles by a sword, without injuring the lungs. He gives from Borellus, Zodiac, med. Gall. p. 156, the case of M. de Serreuil who, wounded by a ball in the chest, died in four hours. The pericardium was found intact, although the blow had ruptured the lower part of the right ventricle of the heart. Morgagni, in his 53d letter, gives a similar case from Vater, that of a woman, in whom, from a blow, the right ventricle was ruptured, the pericardium being whole. He further relates a case from Valsalva of a man, who being wounded between the fifth and sixth ribs, near the sternum, died on the eighth day. The mediastinum had been first wounded, then the pericardium, then the right ventricle, the instrument going also through the diaphragm, through which a quantity of blood had passed into the abdomen.

Courtial in his *Novel, Observ., anat. sur les os* 1705, p. 188, and Saviard, each relate the cases of men, who having been wounded in both ventricles, through the septum, walked five hundred paces before they fell, the patient in each case living five hours. Le Rouge (1792), in a note to an edition of Saviard, published and commented upon by him, relates the case of a man wounded by a sword, who got over the first symptoms indicative of a lesion of the heart, and walked about on the seventh day; on the eleventh he died suddenly after returning from drinking. The sword had passed through the lung, the pericardium, the right auricle of the heart, and both sides of the aorta. Durand, Memoire sur l'abus de l'ensevelisement des morts, Strasbourg, 1789, says:—"In the month of December, 1769, a horseman of the Royal Regiment of Cavalry was wounded by a sword in the chest, lost a quantity of blood, and was left under the staircase of an old half-demolished house, during very cold weather, from Tuesday until the Sunday, when he was found with his legs frost-bitten. He lived ten days afterwards, and then died of the mortification. On dissection it was ascertained that the sword had passed through the right lung and pericardium into the right ventricle. The wounds of all these parts were healed. The man was under the care of M. Chastenet. In another case under the care of the same gentleman, related in the *Journal de Chirurgie Militaire*, tome 2, 1782, by his son, the man lived twenty-four hours after the left auricle and superior vena cava had both been wounded.

Senac, in his *Traite des Maladies de Cœur* says, he was led to conclude from his enquiries that wounds of the right ventricle were more common and more likely to prove quickly fatal than those of the left, from the greater thinness of its walls; and to agree with Glandorp and Schulze that a wound through both auricles must be certainly so. In a series of sixty-four cases collected and published in the *Dictionaire de Medecine*, tome 8, Paris, 1834, p. 245. M. Ollivier found, that, the right ventricle was wounded in twenty-nine cases, the left ventricle in twelve, both ventricles in nine: the right auricle in three, the left in one, the apex or base of the heart in seven, while in three the seat of the wound was not indicated,—differences which the situation of the heart in the chest will account for, whilst the accidental circumstance of the wound being a puncture, or of a larger or smaller size, penetrating or not penetrating the cavities, and especially the ventricles, may account for the greater or less rapidity with which death followed, or for the recoveries which in some instances took place.

In more modern times, and in those nearer to the present day, so many cases of wounds of the heart are to be found, that it would be more than useless to attempt to relate them all. A few are, however, brought forward, in which there could be little doubt that a cure had been effected, and proving in a no less obvious manner that they require all the aid which the science and art of surgery can yield.

London, the great metropolis of the British empire, with its two millions of inhabitants, has been nearly exempt from injuries of the heart. There is not at the present moment a surgeon of any of its largest hospitals who has seen or recollects a case of recovery after a wound of the heart, either in his own practice, or in that of his colleagues or predecessors. They have rarely ever seen a case brought to them alive for treatment; sensible people not being disposed to stab each other, while madmen try to kill themselves in a different way.

CASE 38.—In the Medical Records and Researches for 1798, Dr. Babington relates the case of W. Thomas, of the Foudroyant, who slipped from the gangway at 5 o'clock on the evening of the 25th May, 1798, and fell on the deck below, on his bayonet, which entered the abdomen two inches above the hip bone on the left side, pierced the colon, the stomach twice, the liver, the diaphragm, the right ventricle at its lower part, and came out near the tricuspid valve; it then passed through the middle and upper lobes of the right lung, and proceeded as far as the cartilage of the second and third ribs, near the sternum, going between them, and slightly injuring the pectoral muscle. He lived fourteen hours, having become emphysematous even to the remote parts of the extremities, but very few of the symptoms occurring which usually attend wounds of parts so essential to life.

CASE 39. Mr. Featherston in the 2nd vol. of the *Medico-Chirurgical Transactions*, relates the case of a soldier of the Northampton Militia, who slipping down, run a bayonet into his chest, immediately above the seventh rib. The bleeding was trifling, the alarm great, pulse scarcely perceptible, extremites cold, and the man nearly in a state of syncope. On reaction taking place, respiration became so difficult as to require his being placed in the sitting position. He was blooded to sixteen ounces and expressed himself relieved. He died almost suddenly at the end of forty-nine hours. The bayonet had penetrated the left ventricle about two inches from the apex. There were two quarts of blood in the cavities of the pericardium and pleura.

In the Repertoire D'Anatomie et de Clinique Chirurgicale, there is an instance mentioned by M. Ferus, of a person surviving three weeks, after a watchmaker's file had traversed the left ventricle, and after passing through the septum, had lodged in the right. The pericardium contained a quantity of pus, but the presence of the instrument prevented the flow of blood.

Case 40; published in the fourteenth vol. of the *London Medical Gazette*, page 346, by Messrs. Davis and Steward, is very remarkable from the fact that a piece of wood three inches in length was found on the death of a boy ten years old, five weeks after the accident had happened, to have lodged in the right ventricle, without a mark remaining of the wound in its wall by which it had entered. It was therefore supposed to have perforated the vena cava, and to have been carried by the stream of blood into the ventricle. The boy died hectic. Fournier in the Dictionnaire des Sciences Medicales, "Cas rares," relates the case of a soldier, wounded by a musket ball in the chest, who nearly died of hemorrhage during the first three days. Recovering from this he was restored to health, with the exception of being from time to time troubled with frequent and tormenting palpitations of the heart. He died six years afterwards, and M. Maussion of Orleans, found the ball lodged in the substance of the right ventricle, near its apex, to which part the pericardium was attached, and by it to the mediastinum.

Case 41. Mr. Trigge of Plymouth, has related in the April number of the *Edin. Med. and Surgical Journal* for 1818, the case of a soldier of the Queen's, who was wounded by a musket ball, the night before the battle of Corunna, the 16th of January, 1809. The ball entered between the second and third ribs, near the left side of the sternum. He died on the 30th. On opening the body, *two quarts of serous fluid slightly tinged with blood* were found in the cavity of the pleura. The lung reduced to a small mass, was adhering strongly to the spine. The pleura costalis exhibited marks of high inflammatory action. The pericardium was thickened and unusually distended, containing half a pint of a bloody serous fluid. The surface of the heart was inflamed; a transverse split, an inch in length, was found in the right ventricle, and the tricuspid valve had a lacerated circular opening in it. The ball was supposed to have lodged in the auricle, and to have fallen out during examination into the pericardium.

The Editor adds the case of a Swiss, thirty years of age, who shot himself with a pistol ball, which entered a little to the right and rather lower than the ensiform cartilage. There was no hæmorhage. At the end of forty-four hours he suddenly expired. The ball had passed through the anterior mediastinum, had penetrated the pericardium and right ventricle, and was thrown back it is supposed by the action of the columnæ carneæ, as it was found loose in the pericardium, with a piece of paper which had been used for wadding. There were about two quarts of thick fluid blood in each cavity, and half a pint of grumous blood in the pericardium.

# LECTURE VIII.

*Cases of Wounds of the Heart, by Dupuytren, Percy, Chianea, Steifansand, Sanson, Mallé, Ferus, Velpeau, Frizi, Holmes, Schmucker, Henri, Breschet, and Gualtam; Auscultation of the Precordial Region; Dr. Hope and Dr. Latham's Description of the Precordial Region; Sounds of the Heart; Impulse of the Heart; Use of the Terms Endocardial and Exocardial; Unhealthy Sounds of the Heart and Pericardium; Symptoms indicative of Wounds of the Heart; M. Jobert on the Signs of these Wounds, and their Causes; Propriety of Closing the External Wound in the first instance; Dupuytren's Treatment of the Duke de Berri; Larrey's Cases of Wounds of the Heart; Comments on these Cases; Larrey and Desault's Cases of supposed Traumatic Dropsy of the Pericardium, and the Operation; Larrey's Operation for Hydrops Pericardii; Skielderup's Operation by Trepanning the Sternum; Case of Wound of the Heart and Diaphragm; Influence of the Structure of the Heart on its Wounds; Insensibility of the Heart; Wounds of the Heart by Pins and Needles; Cases by Sir G. Ballingall, Sir Stephen Hammick, and Dr. O'Connor; Death from Blows on the Heart; Medical Treatment; Lacerations and Ruptures of the Heart.*

Baron Dupuytren has related three cases of fatal wounds of the heart, in his *Leçons Orales.* In the first, the individual, Pierre Geray, lived eight days after a transverse wound, three lines and a half in extent, and one line in width, the edges being separated externally, but applied to each other internally. The pericardium contained scarcely an ounce of serous fluid. The left side of the chest contained four ounces of blood from the intercostal artery of the fourth rib, which had been wounded. In the second, the unfortunate man, in an access of despair, thrust a saddler's needle five or six times into the heart, and died three weeks afterwards, when the nature of the injury was discovered. A large ecchymosis was found on the pericardium, which was half filled with blood. The wounds made by the needle were partly closed by coagula: one penetrated the septum, a second the left ventricle, the others the right ventricle, both of which contained some black and fibrinous coagula. During his illness the pulse was not remarkable for anything; the region of the heart was not the seat of any particular movement, nor any extraordinary sound; no fainting, no dyspnœa, nor were there any other symptoms of injury of the heart present. In the third case, the patient had stabbed himself six or seven times with a file, on both sides of the chest, and died in three days. Both sides of the chest contained effused blood, on the left side in considerable quantity, so as to compress the lung, which was not permeable to air; it was furnished by an intercostal artery, which had been wounded. The pericardium was wounded in three or four places, and contained a tablespoonful of blood and pus, the effect of inflammation. The left ventricle was wounded in three places. The right ventricle contained some coagula of black blood, but no wound could be perceived in it. The principal opening in the left ventricle was closed by a coagulum. The pleura shewed signs of inflammation.

Baron Percy, who treats of wounds in the heart, and M. de Blegny, relate instances of the right auricle being wounded, the man in the last case living four days; *Journal de Medicine,* an xi., page 309; and Randall mentions the case of a negro boy, who lived two months and six days after receiving a charge of small shot in the breast, five of which penetrated the heart, three having lodged in the right ventricle, and two in the right auricle.

Case 42.—M. Chianéa, relates in the *Memoires de Chirurgie Militaires,* tome 11, Paris, 1822, the case of a soldier, who survived thirty-six hours after a wound an inch long through the right ventricle of the heart, and which afterwards perforated the centrum tendinosum of the diaphragm, and lodged in the liver.

Case 43.—Steifansand, in Casper's *Wochenschrift,* 1838, relates the case of a young man of 20, stabbed in the right breast, from which wound great hemorrhage followed; it returned on the fourth day, and continued at intervals until his death on the 7th. The right side of the chest contained three pounds of blood, the cartilage of the fourth rib had been cut across, and the arteria mammaria interna divided. The knife had then penetrated the pericardium and the right auricle, the wound in it being two lines long. The right lung was collapsed and useless. This man however was supposed to have died from hemorrhage from the mammary artery.

Case 44.—Sanson, in his *Hemorrhagies Traumatiques,* page 266, relates the case of a soldier who shot himself between the fifth and sixth ribs, and died in the Hotel Dieu, under the care of M. Roux. The ball had lodged between the pericardium, the diaphragm, and the sharp edge of the base of the left lung; the pericardium greatly distended, was not wounded. An incision gave vent to a quart of fluid and some coagulated blood. At the point of union of the anterior surface of the heart with its left edge, there was a loss of substance, of a round shape, contused, unequal, and about two lines in depth and three in width. There was no other wound observable.

In the *Revue Medicale*, for July, 1834, there is the case of a young man who lived ten days after being stabbed in the heart, through the left ventricle, and who died of effusion of blood into the cavity of the chest.

Case 45.—Professor Mallé in his *Clinique Chirurgicale*, Paris, 1838, relates the case of a soldier, wounded between the sixth and seventh ribs on the left side, by the bursting of his friend's gun. The wound which was small, gave passage to neither blood nor air. The heart's motions were obscure and the pulse feeble; reaction taking place in the evening, he was bled twice to ten ounces each time. Next day, pain behind the sternum. The ear distinguished at the part a kind of undulatory crepitation, something like that heard in a varicose aneurism. Elsewhere the respiratory murmur was natural; dyspnœa; bled and cupped; the patient died on the 14th of May, having been wounded on the 28th of March.

In the chest, at the wounded part there was a cicatrix. The right lung presented a small cicatrix near the heart, shewing that it had been penetrated. It was hepatised around for four inches, and united by slight adhesions to the pleura. The pericardium appeared larger than usual, and contained about five ounces of reddish serum, and some fibrinous clots, two of which adhered to the heart. A foreign body was fixed in the left ventricle, and proved to be a part of the stock of the gun, which had burst, and was fixed in the front and about the middle third, its free extremity, which was as large as a full sized writing quill, projecting ten lines. The cavity of the ventricle contained a very firm coagulum, extending into the aorta. The piece of wood had traversed the left ventricle and the septum, and projected into the cavity of the right ventricle.

Life in this instance appears to have been prolonged by the piece of wood blocking up the hole, and preventing the effusion of blood, which seems to have taken place in the other cases alluded to, when the instrument remained in the wound, whilst in those instances in which death occurred more rapidly, there were repeated effusions of blood through the open wounds.

M. Ferus presented to the Academy of Medicine of Paris, in 1826, the heart of a coal-porter, having the mark of a cicatrix, half an inch long in the centre of the right ventricle, the result of a wound he had received in the chest, in a quarrel some seven years before; he died of gastro-enteritis.

Case 46.—Velpeau in his *AnatomieChirurgicale*, narrates the history of a man who died, having nine years before received a wound in the chest from a knife. He recovered after an illness of several months, but remained subject to palpitations. On examination, the wound in the pericardium was found united, the edges adhering to the chest; the heart opposite to this presented a fibrous line, penetrating through the wall of the right ventricle. and it was believed through its inner membrane.

Case 47.—Dr. Frizi, states in il Filiatri Sebezio, p. 27, 1834, that he was called in May, to a young man stabbed in the heart by a knife, which, went through the left ventricle, and wounded the wall of the opposite side. At the moment of the wound, there was a gush of blood, and the man fainted. When seen shortly afterwards, face pale; pulse feeble and intermittent; respiration difficult; slight oppression; deep seated pain in the wound, from which a few drops of blood oozed; intellectual faculties unaffected. The patient gradually improved until the tenth day, when he suddenly fainted and expired. He survived solely in consequence of a coagulum having formed in the ventricle by which the wound was closed.

Case 48.—A man wounded by a knife in the left side of the chest, fell, with little external hemorrhage, and, after rallying in some degree, died in seventy eight hours. On examination, the wound was found to be over the fifth rib, three-quarters of an inch from the cartilage. The left cavity filled with bloody serum; lung collapsed; evidence of intense inflammation; adhesion by bands of pleura, extending from before backwards. The rib was severed; the intercostal artery divided; the knife traversed the pericardium, passing through the left venticle of the heart an inch from its apex, and wounding the diaphragm. The pericardium contained some ounces of bloody serum; few coagulæ were found either in the chest or pericardium.—*American Journal of Medical Sciences.*

Case 49.—Dr. Holmes, of Montreal, was called to a young man killed shortly before, in consequence of having been wounded by the firing of a musket, supposed to have been loaded with large shot, not ball, several of which struck him in the left side of the chest. One only penetrated the cavity, perforated the left lung, struck the pericardium, and dropped into the cavity of the pleura. This cavity contained nearly a pint of bloody serum. The pericardium, containing a considerable quantity of blood, was not perforated, but a transverse linear opening existed in the anterior wall of the right ventricle of the heart, capable of admitting the finger.—*American Journal of Medical Sciences.*

Case 50.—Schmucker in his *Vermischte Chirurgische Schriften*, Band. 2, s. 110, Berlin, 1786, states the case of a soldier, who struck a knife into his chest at the spot where the fifth and sixth ribs join their cartilages. He lost a considerable quantity of blood; had palpitations, small hard and intermittent pulse, oppressed breathing, hard cough, and convulsive movements of the chest. The wound having been dilated to three inches, it was ascertained that the anterior margin of the left lung, the pericardium, and the heart, were wounded, the heart near its apex, *superficially* to the extent of nearly half an inch: the patient lost a quantity of blood from the wound daily, and was also bled on the fifth day; a quantity of whey like fluid of an acid odour flowed from the wound. Purulent expectoration took place, all the symptoms diminished, and in five weeks he was apparently quite cured. A year afterwards he was in good health.

Case 51. A soldier wounded accidentally with a knife, on the 4th, December 1839, between the fourth and fifth ribs, to the extent of an inch, and rather less than half an inch from the sternum, fell insensible after the loss of a quantity of blood, and was carried to the hospital at Strasburgh, and placed under the care of M. Henri. The sounds of the heart on his arrival were obscure and very feeble; the wound was closed, but on making the slightest exertion as in sitting up, blood spirted out as from a stop cock, in a stream the size of a pen, and to the distance of four inches from the chest; he was bled to twelve ounces, which relieved the anxiety and sense of suffocation of which he complained. He was bled next day to eight ounces, and the next day five times, once to twenty ounces, three times to fourteen ounces, and once to ten ounces; the day after three times, to about thirty ounces, and the next day to twelve ounces. The pulse was during this time quick and irregular, and the movements of the heart tumultuous. Oppression trifling. The *bruit de rape* was distinctly heard during the contraction of the ventricles. After this he gradually improved, was allowed to sit up on the 1st, June 1840, and was dismissed cured on the 15th. *Annales de la Chirurgie*, August 1841; *Monthly Journal of Medical Science*, for 1842.

M. Breschet in the Repertoire d'Anatomie, tom, 4. page 196, relates the case of a gentleman killed in a duel, in whom the vena azygos was wounded immediately above where it joins the vena cava; and Guattani in his work *De aneurismatibus* mentions the case of a man who survived a wound of the aorta eight years.

*Auscultation* and *percussion*, and principally auscultation of the whole præcordial region, have afforded means of judging of injuries of the heart, which were not formerly known. Dr. Hope (*Diseases of the Heart*, p. 3,) says:—"A line drawn from the inferior margin of the third rib, across the sternum, passes over the pulmonic valves, a little to the left of the mesial line, and those of the aorta are behind them, but about half an inch lower down. A vertical line, coinciding with the left margin of the sternum, has about one-third of the heart, consisting of the upper portion of the right ventricle, and the whole of the left, on the left. The apex of the heart beats between the cartilages of the fifth and sixth left ribs, at a point about two inches below the nipple, and an inch on its external side."

Dr. Latham (*Lectures on Clinical Medicine*, 1846) remarks:—"If one leg of a compass be fixed at a point midway between the junction of the cartilage of the fifth rib on the left side, with the rib and the sternum, and a circle of two inches in diameter be drawn around, it will define as nearly as possible the space of the præcordial region, occupied by the heart—whilst uncovered, except by the pericardium and some loose cellular texture. In the rest of the præcordial region it is covered and separated from the walls of the chest by the intervening lung."

If the chest of the dead subject be transfixed with long needles, it will be found that the centre of the first bone of the sternum corresponds with the lower edge of the left subclavian vein, and to the arch of the aorta crossing the trachea; the centre of the second bone to the upper edge of the appendix of the right ventricle; and the centre of the third bone corresponds to the right side of the right auricle; the right ventricle being lower down. A needle penetrating the chest at the costal extremity of the fifth rib, close to the upper edge of its cartilage will touch the septum of the ventricle. The apex of the heart is an inch and a half below this, and inclined to the left side.

The semilunar valves of the pulmonary artery correspond to a spot a little below the centre of the third bone of the sternum. The aortic valves are a few lines below and behind the pulmonary. The mitral valves are a little lower, and still more deeply-seated. The pulmonary artery, after touching the sternum, inclines to the left, and is found close to the sternum, between the second and third ribs. The aorta ascends to the first bone, and crosses it to form the arch.

One-third of the heart, consisting of the upper part of the right ventricle and of the whole of the right auricle, is beneath the sternum: the remainder of the right, with the left ventricle and auricle, are to the left side of that bone.

On applying the ear to the præcordial region, the patient being in the erect position, two sounds are distinguishable in a healthy heart,—one duller and more prolonged, the other clearer and shorter: between these there is scarcely an appreciable interval. The period of repose is sufficiently marked before the first or duller sound returns. Of the time thus occupied one half is filled up by the first, or dull sound; one quarter, by the second or sharp sound; one quarter by the pause, or period of repose.

Laying aside certain physiological differences of opinion on the nature and causes of these two sounds during a state of health, it may be conceded in the present state of our knowledge in England, that the *first*, or dull sound, depends on the muscular contraction of the ventricles; and that the *second* arises from the closure of the sigmoid or passive valves of the heart, by the recoil of the blood, thrown back upon them by the aorta and the pulmonary artery.

Andral and others, in France, are not at present inclined to assent to this theory, which they consider too abrupt, and are disposed to attribute the second sound especially to the sudden tension of the sigmoid valves, caused by the blood passing behind them upon their superior surfaces, and as auxiliary causes, the sudden opening of the auriculo-ventricular valves, and the passage of the blood into the ventricles—a difference of opinion without much distinction, and in no way more explanatory even if the theory should prove more correct.

The impulse of the heart, as far as it can be felt by the touch, depends much on the position in which the body is placed. In the erect position the apex strikes between the fifth and sixth ribs. In the recumbent posture, the impulse is almost imperceptible. It is, perhaps, more observable when the body is turned on the right side; but decidedly more so, when it is turned on the left. A clearer sound proceeds from a thin, and a duller sound from a thick heart; a sound of greater extent from a large heart, and a sound of less extent from a small one. A more forcible impulse is given by a thick heart, and one more feeble by a thin one; the impulse is conveyed to a longer distance from a small heart.

From a clearer sound, we believe in the probability of an attenuated heart; but we argue its certainty from a clearer sound joined with a weaker impulse. A stronger impulse denotes the probability of an hypertrophied heart; but we argue its certainty from a stronger impulse with a diminished sound.

Dr. Latham has well inculcated and supported the use of the terms endocardial and exocardial, to designate the alterations which take place in the sounds of the heart under disease: endocardial when they occur within the heart, and exocardial when they take place upon its surface. The endocardial murmur of disease, or bellows-sound, takes place of and is substituted in certain cases for the first or second, or even for both the healthy or normal sounds. The exocardial murmur of disease is heard with the normal sounds, but confusing and overpowering, sometimes overwhelming them by its rubbing or crumpling noise. The natural sounds exist, although rendered imperceptible by the greater distinctness and nearer approach of the unnatural or unhealthy ones.

The heart apart from the pericardium never moves without a sound; the pericardium apart from the heart never gives out one. Under disease, the heart gives out the natural sound, diminished, exaggerated, or modified; or it may be totally altered. The sounds given out by a diseased pericardium must always be new, (there being no old ones) and are described as rubbing, or to-and-fro sounds. The pleura when diseased, being a serous structure, like the inner membrane of the pericardium, gives out less marked but somewhat similar sounds, (the "*frottement*" of the French,) in particular stages of disease.

The alterations in the ordinary sounds constituting the endocardial murmurs of the heart heard under disease, depend principally on the altered state of the endocardium, or membrane lining its cavities; the sounds given off, and called exocardial, on an altered state of the serous membrane of the pericardium, are reflected over the outer surface of the heart. The endocardial or bellows sound, when it accompanies the normal sounds of the heart, may result from any kind of derangement affecting the internal membrane of that organ, particularly rheumatic inflammation, or from any force which may compress its cavities; it may depend on the altered quality of the blood, from anemia. It should be present after excessive hemorrhages have greatly reduced the powers of the sufferer. When this murmur or sound occurs after injury in the vicinity of the heart, and is accompanied by fever, it indicates inflammation of the lining membrane, although no local pain, no palpitations, nor irregular movements of the heart, should be present.

When a murmur or sound is heard of a different kind, possessing the character of friction, or of surfaces moving backwards and forwards on each other, or to and fro,—this sound is the sign of inflammation of the membrane covering the heart, as well as of that lining the fibrous external tissue of the pericardium. The signs of both external and internal inflammation may be present at the same time, and they frequently are in cases of acute rheumatism.

When the heart is supposed to be wounded, even without much loss of blood, there is fainting; palpitation; irregular movement of the heart, or total cessation of its action; coldness of the extremities; ghastliness of countenance; succeeded by great anxiety; a sense of anguish; an intermission or cessation of pulse; followed, if the patient should survive, by reaction, which renders it very frequent, and sometimes increases its impulse, whilst the anxiety is increased by pain, sometimes intolerable, referred to the part. These symptoms imply a serious injury, although they may not all be present, and many of them differ in intensity. If the patient should survive, the ordinary sounds of the heart will return, with more or less irregularity, accompanied after a few hours by the endocardial murmur, although something like it may perhaps be observed from the first period of injury. The friction, or attrition sound, indicating the presence of inflammation of the pericardium, may be absent, and will not be discernible, if a layer of blood is effused into the cavity of that membrane, whilst the natural sounds of the heart are rendered more indistinct as the heart is separated from the walls of the chest by the effusion, which distends the pericardium, whilst it also impedes the regular action of, but cannot compress the heart, as an empyema does the lung. If inflammation take place without an effusion of blood, the friction sound will be heard, and will usually continue even after some effusion of serum and of lymph has occurred, as the quantity of serum is rarely sufficient to prevent the effused and attached portions of lymph from rolling against each other.

The presence of a larger quantity of fluid may be more distinctly known by percussion, if it can be borne in cases of injury, the degree and extent of the dulness being the measure of its existence and accumulation. It may extend over a part or the whole of the præcordial region, reaching as high as the second, or even the first rib, beneath the sternum, and even under the cartilage of the ribs of the right side.

M. Jobert of Lamballe, supposes first that a penetrating wound of the heart gives rise to a peculiar sound, resembling that which is heard in an aneurismal varix. Secondly, That it is accompanied by a constant convulsive action of the muscular fibres of the heart. Thirdly, That the sound ceases if the wound should be closed by a coagulum, but that the convulsive motions continue for some time after if the patient survive. These observations have not been verified in all cases.

That the heart when wounded is capable of recovery by the permanent closure of the wound, in a few rare instances, is indisputable, and it would seem from a consideration of the different cases which are recorded, that such recovery takes place in consequence of there being little blood discharged through the wound, or into the cavity of the pericardium, or into that of the pleura. The absence, or the cessation of hemorrhage, by the contraction of the wound, or the formation of a coagulum, is the first step towards a cure, and it would appear that it is to one or other of these circumstances that most of those who survived the injury for several days or weeks, owed their existence for the time, although they usually died from the effects of inflammation, more of the inner lining and outer covering, than of the substance of the heart itself. If auscultation had been known and resorted to by the older surgeons, who have recorded many of these cases, the cause of the inflammation would in all probability have been discovered.

If the wound be inflicted by a musket or gun-shot ball, it cannot be actually closed, although pressure may be made upon it for a time, so as to suppress the external flow of blood. If this should succeed, it is more than probable that the hemorrhage will continue internally, and that the patient may die after much suffering, principally from oppression, caused by the escape of blood into the cavity of the chest.

If the wound be a stab, the external opening may be accurately closed, and the escape of blood prevented; but as the pressure of the blood in the pericardium is unequal to restrain the action of the heart, blood forced out through the opening fills the cavity of the pleura, and causes suffocation, unless from some accidental circumstance the opening in the heart becomes obstructed, and the bleeding ceases.

If all the circumstances be considered, there can be no doubt of the propriety of closing the wound in the first instance, if the flow of blood is excessive, and appears likely to endanger life. It seems to be as little doubtful that the wound should be reöpened after a time, if the danger from suffocation be imminent; the relief obtained by the escape of a little blood may be efficacious, whilst it does not necessarily follow, although it is more than probable it will be so, that its place will be occupied by a further extravasation of blood, which will prove fatal. It is a choice of difficulties, and death from hemorrhage is easier than death from suffocation.

In the case of the Duke de Berri, whose right ventricle was wounded, and who died from loss of blood, Steifensand reprehends Dupuytren, for having opened the external wound every two hours, to prevent suffocation; but if death were actually impending from the filling of the cavity of the chest, being about to cause suffocation, there was nothing to be done but to give relief at all hazards.

The *Campaigns and Memoirs* of Baron Larrey have not furnished cases of wounds of the heart—sufficient attention could not be paid to them on the field of battle, nor in the hospitals afterwards; they therefore escaped observation. In his *Clinique Chirurgicale* he relates, however, at length, the history of seven cases brought to the military hospital in Paris, the results of duels, or of attempts at suicide, four of which recovered. In the first fatal case, the right ventricle was wounded by the sword. In the second, the ball went through the upper lobe of the left lung, injured the wall of the left ventricle, passed between the aorta and the œsophagus, injuring both, through the root of the right lung, and broke the sixth rib in its passage outwards. No fluid was formed in the left side, but about a quart in the right. In the third case the sword penetrated the pericardium, but did not wound the heart; the internal mammary artery was wounded. The pericardium contained about a pint of fluid. In the first successful case, the pericardium alone was supposed to be wounded by a ball. In the second, the sword injured the lower edge of the seventh rib behind; wounded, it was supposed, the intercostal artery, the lung, the pericardium, and perhaps the heart, in consequence of its pulsations being felt by the end of the finger when introduced through the anterior wound. The posterior wound was closed without attention being paid to the bleeding artery. After much inflammatory action the patient recovered in March, 1820, from the wound inflicted in December, 1819. In the third successful case, Sch—— was wounded when drunk, the 22nd February, 1814, with a sword, half an inch wide, which penetrated between the xiphoid cartilage and the extremities of the seventh and eighth ribs of the left side, through the rectus muscle. He lost a quantity of blood, and appeared to be in great danger. Next evening the wound was enlarged, when a considerable discharge of bloody serum ensued. On the 27th, it being supposed that fluid was effused into the cavity of the chest, a female sound was introduced, and a large quantity of red-coloured fluid evacuated. A gum elastic catheter being then passed in, to the extent of five inches, several ounces more fluid were drawn off, and no doubt remained on the minds of all present that the end of the catheter was struck by and obeyed the movements of the heart. On the 15th April he was discharged cured.

In the fourth or last successful case, P. D. was wounded by a sword, the 13th July, 1826, in the epigastric region, which penetrated the rectus muscle, between the ensiform cartilage and the seventh rib; into which wound a female sound entered to the extent of three inches, and drew off about eight ounces of a reddish brown fluid, with great relief. Before this was done, the pulse could scarcely be felt, extremities cold, the pulsation of the heart very feeble, the false ribs without motion, oppression, extreme anxiety, convulsive movements of the lips and jaws, speechless, prostration extreme; as he had lost a good deal of blood, the wound was therefore closed. On the third day, two ounces of serous fluid escaped on raising the dressings; symptoms of pericarditis becoming evident, he was bled for the first time, and was cupped over the heart. The serous fluid continued to be discharged daily, and became purulent about the eighth day. In forty-five days he left the hospital cured. The pulse remained small, the countenance pale, the side of the chest fallen in a little, and the nipple half an inch lower than that of the opposite side.

These four cases are all apparently wounds of the pericardium, and not of the heart. They are well attested cases of the secretion of the pericardium draining from its cavity for days, and a cure being effected by adhesion, in all probability, of the two secreting surfaces to each other. In the first fatal case, the wound having been closed and having united, effusion or a collection of fluid was supposed to have taken place into the pericardium. The fingers placed upon the cicatrix, received an impulse on coughing as from a fluid, the pulsations of the heart could scarcely be felt or heard, the oppression and anxiety were great. An incision was therefore made parallel to the edge of the sixth rib, a little below the cicatrix. The intercostal muscles between the fifth and sixth ribs were carefully divided by layers, until the pleura was felt distended by fluid; which being penetrated, a quart of a yellowish-brown fluid, mixed with some clots of blood, was evacuated by jets. On introducing the fingers into the opening, the apex of the heart was felt. The wound was closed, but the edges of the opening did not unite, and some reddish colored serum was discharged until the eigthth day, when it became puriform. After this the discharge ceased, and it was necessary to reöpen the wound with a probe, which re-established the discharge, for a time with good effect. Symptoms of general derangement, however, supervened, such as vomiting, colic, dysentery, &c., and the man died sixty-three days after the injury, and twenty-one after the operation. The pericardium was found adherent to the heart, the right ventricle of which was wounded. A newly formed sac, exterior to the pericardium, had been opeued by the operation instead of it. A nearly similar circumstance is recorded to have happened to Desault, who performed the operation in the following manner:—Having made an incision between the sixth and seventh ribs, at the point corresponding to the summit of the heart, he divided the interlacing fibres of the external oblique, and pectoral muscles, and then the intercostal muscles, leaving the internal mammary artery to the inside. The wound thus made being large enough to admit the point of the fingers, a sac containing fluid was discovered and opened. The patient died a few days afterwards, when it was ascertained that the pericardium was below the sac which had been opened, and that it had not been touched. By this method of operating, it is scarcely possible to avoid opening into the cavity of the pleura.

The result of these cases induced Baron Larrey to propose the following operative method for opening into the pericardium, when filled with fluid, (Hydrops pericardii), from whatever cause.

"An oblique incision is to be made from over the edge of the ensiform cartilage, to the united extremities of the cartilages of the seventh and eighth ribs. The cellular tissue being divided with some fibres of the rectus and external oblique muscles, there remain only a portion of the peritoneum, called its false layer, above the pericardium, which can be seen after the division of all intervening cellular tissue, projecting between the first and second digitations of the diaphragm, into which the bistoury is to be entered, with the precaution of doing it with the edge turned upwards, and directed a little from right to left, to avoid the peritoneum. The smallest portion possible of the anterior border of the diaphragm is next to be divided where it is attached to the inner part of the cartilage of the seventh rib. The internal mammary artery is to the outside. The patient should be placed perpendicularly, and supported on his bed, which inclines the anterior part and base of the pericardium, to the fore part of the chest."*

Skielderup recommends this operation to be done by trepanuing first the sternum, a little below the spot where the cartilage of the fifth rib is united to that bone, at which part the periosteum lining it offers considerable resistance, and should not be divided by the trephine. Below this there is a triangular space formed by the separation of the layers of the mediastinum, free from cellular tissue, and tending a little more to the left than to the right. The apex of this triangle is opposite the fifth rib; its base touches the diaphragm. The bone having been removed, the patient is made to lean forwards, when the projection of the pericardium will enable the operator to feel that a quantity of fluid is within, and to open it with safety.

Dr. Skoda of Vienna, has operated in several instances in cases of dropsy of the pericardium, one or two of which are reported to have been successful. An English physician, it is said, has also performed this operation with a canula and trocar, and in so doing transfixed the ventricle, the consequences being immediately or speedily fatal.

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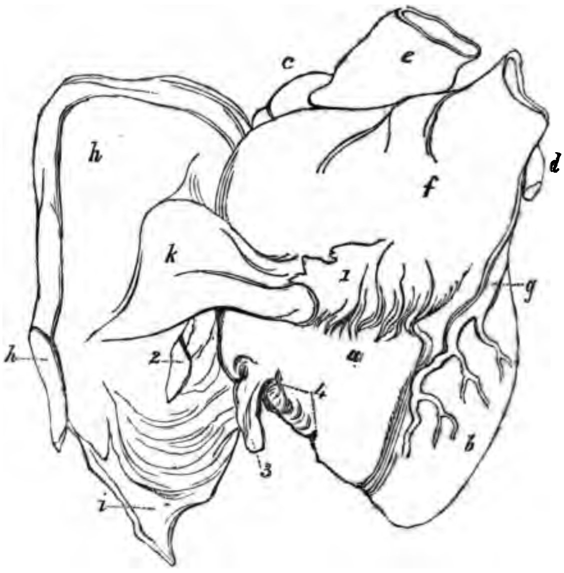
* Larrey—Clinique Chirurgicale, page 303, tome 2.

Case 52.—J. Dierking, a stout muscular man of the third regiment of German Hussars, was wounded at the battle of Waterloo, by a lance which penetrated the chest between the fifth and sixth ribs, and was withdrawn. He fell from his horse, lost a good deal of blood by the mouth, and some by the wound, and was carried to Brussels without any particular attention being drawn to the injury. His strength not being restored, whilst he suffered from palpitations of the heart, and other uneasy sensations in the chest, he was sent to England to be invalided, and from the Savoy Barracks in the Strand, in November, 1815, to the York Hospital, Chelsea, in consequence of an attack of pneumonia, of which he died in two days, without attention being particularly drawn to the wound. Placed on the examination table in the Hospital for a dissection of the perineum, I thought I would not miss the opportunity of tracing the effects of the wound in the chest, in doing which I found to my great surprise that it had been a case of wound of the heart and diaphragm. Having removed the parts, they became the first preparation made for the Military Medical Museum, now at Fort Pitt, Chatham. It is in class 1, div. 1, sect. 7, No. 156.

The lance having injured the edge of the cartilage of the rib, passed through the inferior lobe of the left lung, the track being marked by a depressed narrow cicatrix. It then perforated the pericardium under the heart, and sliced a piece of the outer edge of the right ventricle, which being attached below, turned over and hung down from the heart to the extent of two inches, when in the fresh state, the part of the ventricle from which it had been sliced being puckered and covered by a serous membrane like the heart itself. The lance then penetrated the central tendon of the diaphragm, making an oval opening, easily admitting the finger, the edges being smooth and well defined. It then entered the liver, on the surface of which there was a small irregular mark or cicatrix. The heart in front was attached to the pericardium by some strong bands, the result of adhesive inflammation, but the general appearance of the serous membrane shewed that this had not been either great or extensive. The pericardium was not thickened.

If this man had lived long enough, he might have furnished an instance of hernia of the stomach or intestine into the pericardium.



*a* Right Ventricle.
*b* Left do.
*c* Right Auricle.
*d* Left do.
*e* Aorta.
*f* Pulmonary Artery.
*g* Coronary do.
*h* A portion of the Cartilages of the Ribs seen on the inside.
*i* A portion of the Diaphragm.
*k* The Pericardium.

1. A portion of the Pericardium reflected to shew abnormal adhesions to the surface of the Heart.
2. Aperture of Wound through the Diaphragm and the Pericardium.
3. Pendulous Slice off the substance of the Right Ventricle.
4. Puckered Cicatrix of the Wound of the Ventricle.

Dr. Hennen has given an erroneous account of this case from Dr. Blackadder, one of the Assistant Surgeons at York Hospital, who was not present at the opening of the body, but merely had charge of the preparation at a subsequent period.

The *structure* of the heart exerts considerable influence on the nature of the wound, and on its tendency to remain open, or to become contracted and partially closed. MM. Vaust and Gerdy have shewn that the ventricles of the heart are composed of three layers of fibres superimposed one on the other. The outer and middle of the left ventricle descend from the base to the left of the apex. The inner layer, which surpasses in thickness the other two, crosses them almost transversely, so that a small slanting wound of the anterior part of the left ventricle, extending across towards the left side from a quarter to half an inch, would do little more than separate and injure the two anterior layers, whilst the third or deep one would be cut across. The wound, under such circumstances, would neither be wide nor direct; its irregular contraction would offer obstacles to the passage of blood, might even give time for its coagulation, and thus offer a chance of complete obstruction and obliteration; as much will also depend on the obliquity with which the instrument passes into the heart, as on the smallness of its size, a mere puncture being often followed by little inconvenience, although the retention of the weapon will often give rise to the most serious symptoms.

That the heart when exposed is insensible, or nearly so, to the touch, was known to Galen and to Harvey. Galen is said to have removed a part of the sternum and pericardium, and to have laid his finger on the heart. Harvey did the same in his experiments on animals, and on the son of Lord Montgomery, who was wounded in the chest. Professor J. K. Jung not only introduced needles into the hearts of animals, but also galvanised them; and Mr. Searle in India is alleged to have tried acupuncture of the heart for the cure of cholera without disadvantage. Peyron punctured the heart of a young woman, eighteen years old, for the relief of rheumatism, with needles, two of which, it is said, remained inserted in the heart for forty-eight hours, and it is affirmed with success.

Although needles when withdrawn are said to do little mischief, they are the cause of death when they remain, and generally from inflammation. Zacchias reports a case, vol. 1, lib. v., let. 2, quest. 2, in which a madman, who had otherwise mutilated himself, lived six days, after pushing several needles into his heart. Renauldin says, in the *Archives Gen. de Medecine*, for 1833, that another maniac in the Hopital Beaujon, in Paris, lived several weeks after running a needle three inches long into his heart, and then died of pericarditis. Sue records, in the *Recueil per.* t. 8, p. 31, the fact that a lady of rank in Sardinia, in 1728, killed her husband almost suddenly by means of a gold pin, which she thrust through the right ventricle of the heart whilst he slept.

Sir G. Ballingall reports, page 296, in his *Outlines of Military Surgery*, that Admiral Villeneuve is supposed to have died suddenly, from running a pin into his heart; and that Dr. Grace, of Cupar, had informed him of the death of an individual in his neighbourhood, in two days, who had run a large worsted needle into his right ventricle.

Case 53.— In the *Journal Medical Militaire de St. Petersbourg*, vol. 29, part 2, it is stated that a soldier was brought to the hospital of Lublin, who had, two days previously, thrust two needles into the præcordial region of the chest, where they remained. He died on the nineteenth day. The two needles were found in the inferior part of the left lung, with the points turned towards the pericardium. This part of the lung was the seat of a diffused inflammation for several inches. Purulent matter had formed in the track of the needles from the ribs. The pericardium was thickened, and contained a quantity of puriform fluid, like the deposits of all serous inflammations. The layer attached to and deposited upon the heart was two lines thick, as well as that upon the lining of the pericardium itself. The ventricles contained coagulated blood.

Sir Stephen Hammick, when Surgeon of the Royal Naval Hospital at Plymouth, had a case reported by Dr. Hennen in his *Military Surgery*, in which a pin was lodged in the heart, the patient not being aware of it. He died, having complained of pain in the part for three months before, of hypertrophy of the heart, effusion of lymph, and adhesion to the pericardium.

Case 54.—In the *Medical Gazette*, vol. 17, page 82, it is related of a gentleman, that he pushed a darning needle into his chest, between the fifth and sixth ribs; acute inflammation of the heart or its membranes followed, and Dr. O'Connor bled him to sixty ounces, when he was able to lie down. In forty minutes the symptoms returned, when the patient confessed what he had done. An incision was made, and the end of the needle discovered, which could only be seized by a pair of watchmakers fine forceps; on its withdrawal it was found to be three and a half inches long. The symptoms subsided, and in five days he was well; he lived ten years afterwards.

That a person may die from the shock of a blow on the heart, need not be doubted, and that they do die when little blood is lost, is admitted. History preserves the fact, that Latour d'Auvergne, who had obtained the honourable title of "Premier Grenadier de France," and Captain of the 46th demi-brigade fell, and died immediately after receiving a wound from a lance at Neustadt, in the month of July, of the sixth year of the Republic, which struck the left ventricle of the heart, near its apex, but did not penetrate its cavity. He was, however, sixty-eight years of age.

I have little to state with respect to medical treatment, from experience. All extraneous matters should be removed if possible, and all inflammatory symptoms should be subdued by general bleeding, by leeches, by calomel, antimony, and opium, &c. The chest should be examined daily by auscultation, and as far as may be by percussion. If the cavity of the pleura should fill with blood, it ought to be evacuated to give a chance for life, as in other cases of a similar nature, to be hereafter noticed, and if the pericardium should become permanently distended by fluid, it should be evacuated by the method of Harvey, which appears to be the best.

*Lacerations and ruptures of the heart* have frequently taken place from blows or other serious contusions. Sanson, *Plaies de Cœur, Théses* 1827, reports a case in which the man lived thirteen days after a piece of the sternum, an inch long, had been driven into the substance of the heart, without penetrating either of its cavities. Blancard, *Anat. Pract. Ration*, Amsterdam, 1688, says, that a peasant was run over by his cart loaded with hay, causing pain in the chest, without fracture of the ribs or sternum; he resumed his labours after four days' rest, but being attacked by fever some days afterwards, died on the eleventh day of inflammation with ulceration of different spots on the surface of the auricles, and of the upper part of the left ventricle.

It would serve no practical purpose, to occupy more time or space, in the relation of particular cases of rupture of the heart from accidents. Ollivier, loco citato, who devoted much time to reading and collecting the observations made by different writers on the injuries of the heart, says, page 343, in confirmation of the remark of Morgagni, Epist. xxvii. sect. 10, " that of forty nine cases of spontaneous rupture ot the heart, thirty-four were of the left ventricle, eight only of the right, two of the left auricle, three of the right, and that in two cases, both ventricles were torn in several places; and that these results were in an inverse proportion to those which occurred after blows or contusions; the right ventricle being ruptured in eight out of eleven cases, the left ventricle three times; the auricles being also torn, in six of these eleven cases; the ruptures not being confined to one spot, but taking place occasionally in several different parts, or even in the same ventricle. In eight of the cases he had noticed, the heart was ruptured in several places, and he refers, in proof among others, to the works of Morgagni, Epist. 64, sec. 15, of Rostan, *Nouv. Journ. de Med.* 1820, *of* Portal, *Academie des Sci.* 1770, p. 51, *of* Andral Fils. *Arch. Gen. de Med.* t. 4, p. 616, *of* Ashburner, *London Med. and Phys. Journal*, December, 1822, *of* Bland. *Biblioth. Medicale*, vol. 62, p. 364, 1820. Some of them, as noticed by Ploucquet and Bayle, quoted in the *Revue Medicale*, for July, 1824, resemble the wounds made by a musket ball. A spontaneous rupture of the heart, from any of the several causes which may give rise to it, is not always, although it is in general immediately fatal. Frank, *De Rupt: Cordis*, vol. viii., reports a case, in which the patient lived twelve hours after its occurrence; and in *Rust's Magazin, &c.*, vol. xvi., p. 92, there is another, not however spontaneous, in which a child, six months old, lived fourteen hours after the right auricle had been ruptured. That a spontaneous rupture may be cured, seems likely from a case reported by Rostan, of a woman, who died after fourteen years suffering with pain about the heart, and was found to have ruptured the ventricle; a cicatrix was observed to the left side of the recent rupture, half an inch in extent in every direction, and in which the new matter was evidently different from the natural structure of the heart.

## LECTURE IX.

*Penetrating Wounds of the Chest; Stab by a Triangular Sword, small Knife, or other Weapon; Symptoms and Treatment; Examination of the Wound by Probes not generally admissible; Dr. Mayer's Case of penetrating Wound made with a Knife, and retention of part of the Knife in the Wound for some days; the Question of Closure of the External Wound; Paré's Opinion, illustrated by Cases; Wurtz' Opinion; Sucking the Wound, its Advantages and Dangers; La Motte's Cases of Penetrating Wounds; Ravaton, Dionis, and Larrey on the Closure of the External Wound; Effects of Sucking the Wound; Position in Incised Wounds of the Chest; Case of Bayonet Wound in the Chest; Treatment of Incised Wounds of some extent; Use of the Suture through the Skin only; Consequences of such Wounds; Existence of Alarm or Shock, immediately consequent on the Wound; Treatment of the Re-action; Inflammation of the Pleura; Wounds of both Cavities of the Chest usually regarded as Mortal; Cases; Mr. Keate's successful Case of Sword-thrust through the Chest; Fatal Case of Pistol-shot Wound, involving both Cavities; Two Important Points in the Treatment of Large and Direct Incised Wounds of the Chest; Mr. Hewson's Mode of proceeding, Closure of the Wound, confirmed by later Writers; Effects of the Closure of the Wound; Effusion into the Cavity the Natural Result of Inflammation, which has passed the Stage of Adhesion; Two Cases in which Closure of the External Wound was successfully practised; the Non-closure of the Wound endangers the Extension of Inflammation to the whole Cavity of the Pleura, with subsequent Effusion; Cases by Mr. Stanley, and Dr. Foltz; Indications of Effusion; Cases; Hæmorrhage from Penetrating Wounds of the Chest; Difference of Opinion as to the Treatment when the Hæmorrhage is severe; the proper Treatment to be pursued; Re-opening the Wound, to evacuate the Effusion, when the Hæmorrhage has ceased; when the Inflammation has passed the Adhesive process, and Effusion has taken place, the sooner a free Discharge is effected, the better; Treatment to Arrest the Hæmorrhage, other than Closing the Wound; Cases by Dionis, Le Dran, and Mr. Guthrie; Valentin on the Treatment of Hæmorrhage in such Cases; Pechlin's Case; Commented on by Valentin; Valentin on the Ecchymosis indicative of the Effusion of Blood into the Chest; Saucerotte's Case; Larrey's Cases; General Conclusions.*

The simplest injury, perforating the wall of the chest, is a stab by a triangular sword, or small knife, or other weapon, which may or may not abrade the surface of the lung, and which is usually attended by little pain, although it often gives rise to considerable alarm. It might be supposed that a very slight injury of the lung would be followed by some expectoration of blood, but this does not always take place; and although its presence may be considered demonstrative of the fact, its absence is no proof of the contrary; for a considerable injury from a stab and from a musket ball may be inflicted, with scarcely, and sometimes even without any sign of blood in the matter expectorated. If the pleuræ are in their natural state, a small quantity of air may enter the chest, but the opening will require to be direct, and tolerably large, before the lung will separate or shrink from the wall on this account; and if adhesions should have been previously formed between the pleuræ, they will be for the advantage of the sufferer. In all these cases, the closure of the parts by a compress on the removal of the weapon, together with the effusion of blood into the cellular membrane, although to a small extent, are sufficient to obviate further mischief; and if proper care be taken to prevent and subdue inflammation, if it should extend beyond the bounds of healthy action, the patient will soon get well.

In a simple incised wound, injuring the lung perhaps extensively, as supposed from the bleeding from the mouth, no examination by probes or other instruments need or ought to be made as a general rule; but the wound should be immediately closed, after the external parts have been sufficiently examined to satisfy the surgeon that no portion of the offending instrument is broken off and sticking in.

Case 55.—Julian Busse, 17 years of age, having fallen on the ice, was brought to Dr. Mayer, in 1801, in an apparently dying state, with a very small wound in the left side of the chest, corresponding to the interval between the seventh and eighth ribs. The lad thought it was made by a sharp-pointed knife he had in his pocket, the handle of which alone could be found. After some days, as the symptoms of inflammation increased, a closer investigation was made, and something hard felt in the situation of the little wound, which being laid open, shewed the broken blade, which was extracted by means of a strong pair of forceps. The wound thus opened discharged a quantity of matter for a long time; symptoms of phthisis supervened, matter was coughed up, and the patient escaped after a length of time, with difficulty.—(Dr.

Mayer, *Tractatus de Vulneribus Pectoris Penetrantibus*, p. xxvii. *Petropoli*, 1823.)

If the blade had been withdrawn in the first instance, the wound in the lung and the pleura would in all probability, under proper care, have healed without passing into the suppurative stage.

It has been a question, from the earliest periods of the middle ages, whether this should or should not be done, as may be seen in the writings of Guy de Chauliac, born about the year 1300, and of John de Vigo in 1460. Paré, 1510, describes his practice in two successive cases. In the first, the soldier had one wound, out of three, which penetrated the cavity of the right side of the chest the width of five fingers, which Paré says had been indiscreetly sewn up, because the surgeon had not seen whether it penetrated the cavity or not. Being called to the case next day, he found the patient could hardly speak or breathe, suffering great pain at the wounds, coughing and spitting blood, with considerable fever. He therefore re-opened the wound, had the patient held up by the legs and turned on the wounded side, that the effused contents of the chest might be evacuated; after which he daily washed out the chest, first with bitters, and afterwards with mild injections, leaving a canula in the wound, and in due time the patient recovered.

In the second case, in a German gentleman living in the Rue Saint Denis, who had had a tent placed in his chest the day before for a wound he had received, Paré withdrew the tent because nothing had been poured out into the cavity, and closed the wound, the patient getting well; and he protests that a similar result had followed such treatment in many other cases. His precise direction is to keep the wound open two or three days, to see if effusion of blood took place, and if none occurred the wound was then to be closed.

Wurtz, in 1576, however, laid it down as a general rule, that all wounds penetrating the cavity of the chest should be closed by suture—a proceeding he objected to in most wounds in other parts of the body; his advice does not however appear to have been followed.

The advantages derived from the closure of such wounds led to the practice of sucking them by the mouths of irregular practitioners, generally the drum major of the regiment, when the patient was a soldier; and the consequences, although in some instances apparently miraculous, were in others quite as unfortunate.

La Motte, who was practising as far back as 1696, says, page 18 of the *Complete Treatise of Surgery*, that he saw two soldiers, who, he did not doubt, had been run through the body, and who, after being sucked, recovered so as to be able to walk about the streets next day; and he honestly adds, that if the suckers would confine their practice to proper cases—to those in which there was no particular bleeding—that their method would be better than those more purely chirurgical and scientific. The suckers merely washed their mouths with a little wine from time to time, and when they had done they applied chewed paper to the wounds. They did not, however, omit to mutter some words, supposed to be cabalistic, and which gave offence to the clergy, who would not administer the last sacrament to the wounded so practised upon; but La Motte says it was not necessary to understand magic, whether white or black, to be able to practise so simple an art.

Case 56.—La Motte was called in May 1696, to a soldier, who being wounded by a sword between the fifth and sixth ribs near the sternum, had been sucked by the sucker of his regiment. As he had not spit blood, La Motte thought that the great difficulty of breathing under which he laboured arose from an extravasation of blood within the chest; he therefore passed a hollow sound through the wound into the cavity, and drew off a pint and a half of blood, which gave him great relief; as the oppression returned, he repeated this operation with the same result, but not to the same extent. It was done every day for ten days, when the discharge, although still reddish, became serous. This gradually diminished, and he was cured in a month.

It is very likely that the lung was scarcely hurt in this case, but it is possible that an intercostal or internal mammary, or some other vessel within the chest, was injured, giving rise to the bleeding.

Case 57.—In his 217th observation, La Motte says he was called, in July 1697, to a grenadier wounded nearly in a similar manner, and sucked after the most approved fashion. About to die of suffocation, La Motte drew off the extravasated blood, and saved his life. This he was obliged to do again next day, the discharge continuing for four days. This man recovered sooner than the other.

Case 58—218 of La Motte—remarkable for the size of the wound from a sword, which entered the chest, near the arm-pit, from which the patient lost a quantity of blood, as well as by the mouth, and was nearly suffocated. La Motte removed some twenty ounces of red blood from the chest by his hollow sound; dilated the external parts, &c. The next day he drew off a similar quantity, and repeated it for five days, after which it gradually became purulent. At the end of a month, four ounces only of a very offensive pus were discharged daily, and this with difficulty. La Motte found out, very luckily, that the best way of removing it, was by making the man speak. He therefore set him to say his prayers, until the cavity of the chest was emptied by the motion, this course probably being aided by position; La Motte adds, that he knew his prayers very well for a dragoon.

Ravaton follows La Motte, in his approval of this practice in simple cases. Dionis affirms that continued bleeding is the only good reason for not closing a wound in the chest by the ordinary surgical means. Baron Larrey has zealously supported this practice, and is said to have re-introduced it into France, where it had possibly fallen into disuse; although I am not aware that any other practice was pursued in England during the last fifty years; and as to the sucking, I confess my belief that, in proper cases, it is the best method of proceeding.

That bleeding should take place into the cavity of the chest from the lung is indisputable, but little or no blood will escape through so small a wound; and its flowing from a very small wound will be a presumptive, if not a conclusive proof, that some artery external to the pleura has been wounded. Sucking under ordinary circumstances, of a small wound, unattended by bleeding, does good by attracting the natural fluids to the parts, and thus causing them to swell, so as to be placed in apposition in the most advantageous manner for their re-union. Sucking, in all probability, has little or no influence on the inside of the chest: and punctured wounds of small size may therefore be sucked chirurgically, instead of washed, if any one is willing to do it; after which, a bit of gold-beater's skin, or dry lint, is to be placed upon it, supported by a compress covered by adhesive plaster; these dressings should not be removed for several days, unless symptoms arise indicating mischief within the chest, requiring particular assistance.

In all cases of incised wounds of the chest, the patient should lie on the wounded part, as a general rule, if he can conveniently bear it; not for the purpose of allowing any effused blood or fluid to flow out, unless some particular reason requires this precaution of keeping the wound open; but to allow the pleura covering the lung to be as closely applied as may be to the pleura lining the wall of the chest, with the hope that the adhesive process may take place between those parts, and by this means cut off the wound from the general cavity of the pleura.

Case 59.—A grenadier of the 29th regiment was stabbed by a bayonet, on the heights of Roliça, in 1808, in the right side of the chest. The triangular wound was small; and it did not appear, on measuring a French bayonet, that it had gone in beyond three inches. He spit a little blood, which soon stopped, and he did not suffer any pain worthy of complaint. A compress and piece of adhesive plaster were applied, and allowed to remain on for several days. He recovered after one good bleeding and a little starvation, without any bad symptoms, and suffered no inconvenience afterwards.

It is probable that in this case the lung never receded, and that the cut parts united by the adhesive process, the pleura pulmonalis adhering to the pleura costalis.

*Incised* wounds of greater extent ought never to be examined by probe or finger; no disturbance of any kind should be permitted, unless the cartilage or bone be injured; and the external parts should be brought together as closely as possible, so as to facilitate in every way their union, and the processes which it is desirable should go on within. The external parts, or skin and cellular membrane, can rarely be kept in perfect and continued apposition without sutures; and the method of proceeding I recommend is to sew up the wound in the skin with a needle and fine silken thread, in a continuous manner, including absolutely nothing but so much of the cut edges as will retain the thread: a small piece of gold-beater's skin, or lint, should then be laid over the stitches, and retained by a compress and adhesive plaster.

In a simple case of this kind little or nothing is effused into the cavity, or secreted from the membranes of the chest, which will interfere with the process which may have happily begun, and which it is desirable should be aided by the absolute quiescence of the patient, to whom no medicine should be given which may render any movement of the body necessary. It was formerly supposed that the greatest object to be attained was the prevention of inflammation; and a man was no sooner stabbed by his opponent, than he was blooded by his surgeon, regardless of the necessity which existed for the presence of a certain amount of inflammation in order to enable nature to carry on those processes which are essential for the restoration of the injured parts. This inflammation should be allowed to commence without interference, and to continue in a moderate degree, until the object shall be effected. It should only be interrupted or subdued when it is supposed to be about to exceed that degree which experience has pointed out as likely to be useful.

When the most courageous persons are wounded in parts which are usually considered essential to life, there is more or less alarm or shock created by the injury; although it has been gravely argued that a man does not always know when he is actually shot or run through the body. I have not met with such cases; and consider a continued state of anxiety and depression after an accident of this kind a disagreeable accompaniment of the injury, during which little should be done beyond quieting the apprehensions of the patient, and leaving him to rest if possible, after the absolutely necessary applications have been made. If a gradual improvement take place, if the pulse rise, if the patient resume more of his natural appearance, and that state of commencing excitement which is denominated reaction, follow, some hopes may then be entertained. The general symptoms, as long as they continue within ordinary bounds, are of little importance; the local ones, significative of action commencing in the injured part, are, however, to be carefully watched. They are those of inflammation of the pleura, and it may be of the lung. This inflammation begins slowly, and a day or even more may elapse before it is well marked; and when persons have died within the first few hours from such injuries, the pleura has often shown but little sign of inflammatory action.

Auscultation should always be resorted to from the moment of injury, and constantly used throughout the treatment; although the patient should not be moved from off the wounded part. Whenever it is concluded that adhesion between the two pleuræ has failed to take place, this direction ceases to have the same importance; but until this period no food whatever should be allowed, and thirst should be allayed by small quantities of water.

A punctured, incised, or gun-shot wound, going fairly through both cavities of the chest, is usually believed to be quickly, if not immediately mortal; an opinion which will in general be found to be correct with respect to wounds made by musket balls, although it is certainly not the case with regard to punctured wounds, and does not always occur in those made by small, or pistol-balls.

Case 60.—Sergeant-Major Richards, of the 29th Regiment, received thirteen sword or bayonet wounds, and other injuries, on the heights of Roliça, on the 17th August, 1808, one particularly through each side of the chest, between the ribs, as if the small sword or bayonet had made a deep, and consequently a triangular wound, of larger size than usual. He had distinguished himself greatly in covering the body of his commanding officer, and was thus beaten down before the British column could rally and recover its ground. He was an object of particular attention to me, for the few minutes he lived after I saw him; he had coughed up a little blood, and died gasping, as if suffocated, the chest labouring on each side to do its work in vain. His commanding officer, Lieut.-Col. the Hon. George Lake, lay dead by his side, killed instantaneously by a musket-ball, which passed from the upper part of the left through the right side of the chest.

Case 61, by Mr. Keate.—A French gentleman fencing with an Englishman in July, 1834, received a blow under the right axilla in a very violent lunge, whereby the button of the foil was broken off, and the foil itself passed into and through the back part of the thorax, the point coming out between the sixth and seventh ribs on the left side, near the angles. There was but little bleeding. The chief symptoms were those of great inflammation of the contents of the cavity, which gave way to full and repeated bleeding from the arm, with perfect rest and almost starvation. He recovered very favourably, and was quite well in about eight weeks. He remains well, and is following his profession as a teacher of fencing, I believe, at this moment, in Paris.

Case 62.—Lieut. O. was wounded, in 1814, by a pistol ball, at twelve o'clock, which entered, as was afterwards ascertained, a little above the nipple of the right breast; fractured the third rib; passed through the right lung near its root; entered the posterior mediastinum; took away a portion of the œsophagus, about the size of a shilling, from its anterior part, where the trachea lies upon it, but without wounding the latter; it then penetrated the substance of the left lung, fractured the fourth rib, and lodged in the integuments below the left axilla, whence it was afterwards removed. He was largely bled, and taken to his quarters. His countenance was pale, lips livid, pulse small, breathing hurried and difficult, and he complained more of a sense of suffocation than pain. Emphysema had a little puffed up the left side of the chest and neck, and at every expiration the air rushed through the wound with a force sufficient to blow out a candle; his voice was not at all impaired; at about ten o'clock in the evening he breathed his last. On opening his body the ball was found to have traversed the chest as before described; a large quantity of fluid blood was extravasated into each cavity of the thorax.

I have seen several cases in which, from the apparent course of the balls, it seemed probable that both sides of the chest had been penetrated. At Brussels, for instance, in one soldier a ball had entered to the left of the sternum, and came out, passing under that bone on the upper and fore part of the chest. The right side of the chest was certainly penetrated, but I was by no means certain as to the left; nor, in another case, in which a ball assuredly passed from side to side under the sternum, was it manifest that the right side was actually opened into. Nevertheless, as men have survived for some hours at least, after both cavities have been penetrated by small musket-balls, and some appear to have recovered, it must be admitted that a wound, and particularly a punctured wound through both sides of the chest, is not necessarily fatal.

When an incised wound or stab into the chest is large and direct, injuring the lung, two very important points usually demand immediate attention. The first is, to relieve the oppressed state of the breathing; the second, to suppress the bleeding, if profuse.

Mr. Hewson, in his paper on Emphysema, published in the third vol. of the *Medical Observations and Enquiries*, for 1767, has stated that in large penetrating wounds of the chest, with injury of the lung, the patient has breathed most easily when the external wound has been covered, and has been hardly able to breathe when it was opened, which he attributed to the air getting into the cavity of the thorax in inspiration, instead of entering the lungs by the trachea. Later experience has confirmed this fact, as well as that advanced by Le Dran, that the closure of the wound was the most efficacious means of arresting hemorrhage from the lung. The result of the closure of the wound in the first case is, that adhesion may take place, and under proper management the inflammatory action within the chest may terminate; but if the inflammatory symptoms continue, adhesion does not take place, and the secretion and effusion of a quantity of serous fluid are the consequence. This secretion of fluid is the natural consequence of inflammation which has passed the stage of adhesion, whether the injury of the chest has occurred from a stab or from a gun-shot. It is the leading fact in the treatment of these injuries, and has hitherto been disregarded by writers on this subject; but on the proper management of which, in both instances, a successful result principally depends. If the closure of the wound leads to the re-establishment of the breathing; and the antiphlogistic means employed (and they must be of the most rigorous nature as regards abstinence and general and local bleeding) to the cessation of all urgent inflammatory symptoms in the course of a few days, adhesion has most likely taken place, or is about to take place, in the neighbourhood of the wound; and the patient will in all probability recover without much further suffering.

Case 63.—A soldier of the ninth regiment was wounded at Roliça, in 1808, by the point of a sword in the left side; it penetrated the chest, making a wound somewhat more than an inch long, which gaped, and through which air passed readily, accompanied by a very little frothy blood, which was also spit up on any effort being made to cough; leaving no doubt of the lung having been injured, and which appeared to be retained against the wall of the chest. As the edges of the wound could not be accurately kept in apposition by adhesive plaster, I inserted two sutures through the skin, and thus brought them together; and the man was desired to lie on the injured side, with the hope that adhesion might take place, as there appeared to be no effusion into the cavity, probably from the pleuræ having adhered from previous inflammation. This man was freely bled on each of the two days following the receipt of the wound, in consequence of pain and other signs of inflammation coming on; after that he gradually recovered.

Case 64.—A French soldier was brought into the village after the battle of Vimiera, on the 21st August, 1808, who had been wounded by a pointed sword in the right side of the chest. He said he had lost a good deal of blood; was very pale; pulse small; extremities cold; breathing hurried and oppressed; had spit up some blood. On removing the handkerchief, a gaping wound, an inch and a half long, presented itself; through which, if a pair of forceps were passed, and a little separated, the cavity of the chest could be seen, the lung having receded. The wound did not bleed. As adhesive plasters would not keep the edges of the skin in perfect contact if he attempted to move, they were sewn together, and after the application of a compress he was much relieved. The next day all the symptoms were much alleviated, and I was subsequently informed that after the supervention of some inflammatory symptoms, which were steadily subdued, he was forwarded to Lisbon for embarkation for France, in a fair state of recovery.

It was the successful results of these cases which led me afterwards to close all such wounds in the first instance, with the hope of preventing thereby the extension of the inflammation—which must of necessity be set up in the part—to the whole sac of the pleura, which in many instances it succeeds in doing; and that which was done from apparent necessity, rather than scientifically adopted, became with me a rule of practice, which may be laid down as a principle to be followed in similar cases. When persons thus wounded are neglected in the first instance, the wound remains open; the inflammation may not afterwards be effectively subdued; and the cavity of the pleura passes into a state of suppuration, after all the symptoms have taken place of acute pleuritis or pleuro-pneumonia: but these symptoms may also occur even if the wound appears to close, and must be treated accordingly.

Case 65, by Mr. Stanley.—I was summoned to a young medical man, who, a few hours previously, had passed through the left side of his chest a double-edged amputating knife, of the usual size employed for amputation of the thigh in adults by the circular incisions. The knife entered just below the nipple, and passed out of the chest an inch and a half from the left side of the spinous process of the third dorsal vertebra. Considerable emphysema ensued around both wounds in the walls of the chest, and for several days a small quantity of blood was mixed with the sputum.

Not a bad symptom of any kind followed, no dyspnœa, disturbance of the circulation, nor other ill consequence. He was very freely bled three times, when the state of the pulse appeared to indicate it. He took nothing but toast and water for five days, when he was pronounced well. He recovered his usual health without further interruption.

Case 66, by Dr. Foltz, of the American navy—A young man from the Ohio, a servant of Lieutenant Ganzevoort, was admitted with a wound of the right lung from a blow with a Spanish knife. The weapon passed over the edge of the scapula, entering the thorax between the first and second ribs from behind. He ran to the first door, and fell senseless, expectorating large quantities of blood. Our first object was to induce syncope, which was readily effected by allowing the blood to flow freely from the wound. The *deliquium animi* being complete, there followed for the time an arrest of the hæmorrhage. The intercostal artery was not divided, but judging from the copious hemorrhage, the knife must have penetrated deeply into the substance of the lung. The edges of the wound were brought into apposition by a deep interrupted suture, compress, and bandage. The patient was ordered to be kept perfectly quiet, and not even permitted to speak, and two grains of the acetate of lead were ordered every two hours. The patient was almost completely exhausted in consequence of the loss of blood, by which only the internal bleeding was arrested. On the following morning it was found that the function of the right lung, in consequence of the internal effusion of blood, had been almost entirely suspended, respiration being carried on by the lung of the opposite side. The bowels were opened by an enema; the acetate of lead was still continued at greater intervals; and cooling acidulated drinks were given in small quantities.

Third day: Some expectoration of blood during the night; complains of pain and soreness in the right chest; but the external wound is healing by the first intention. Seidlitz powders ordered every two hours, until the bowels be moved, also an infusion of sem. lini, acidulated, for a common drink, with perfect rest.

The temperature of the apartment was kept as high as the patient could endure without inconvenience, and in so doing we had no reference to the thermometer, which, for the three weeks immediately succeeding the accident, never fell below seventy degrees, and usually stood near seventy-six. To this high temperature we attribute, in a great degree, the recovery of this patient from a most formidable wound; and the efficacy of this treatment we have since had ample opportunity of testing in various cases. Indeed, no means with which we are acquainted promotes union so rapidly in lesions of all the tissues, including even fractures of the large bones, as a high temperature.

Fifth day: The surface of the wound has completely united, but there is evidence of incipient emphysema; the subjacent parts are elevated and puffed, the lower costa of the scapula projects, and there is daily an expectoration of blood, which gradually diminishes in quantity. On the removal of the suture, the newly cicatrized wound opened readily, allowing a quantity of air and serum to make their escape.—ol. ricini ℥j., which operated freely.

Seventh day: The patient is much more comfortable since the wound commenced discharging. There is a constant oozing of serum mixed with small bubbles of air; the tumefaction under the scapula is much reduced; the right side and shoulder are much discoloured from ecchymosis; respiration has become more natural, and is unaccompanied with pain.

Tenth day: This morning there is a slight return of hæmorrhage from the lungs; ordered the acetate of lead to be resumed, and an enema to be administered.

Fourteenth day: The discharge of serum and air from the wound has daily diminished in quantity; the respiration has become easy, the patient being now able to breathe in the horizontal position, having been heretofore obliged to remain with his chest almost erect; a more nutritious diet allowed.

Nineteenth day: The wound has again united; free expectoration; respiration is daily improving, in proportion to the absorption of the effused blood. Eight weeks after the receipt of the wound, the patient was returned to duty on board ship.

Dr. Foltz thinks the happy termination of this case, must be attributed to the syncope from the loss of blood, immediately after the injury was received, and perhaps to the beneficial effects of the high temperature preserved throughout the treatment.

If the union of a large incised or other wound by the adhesive process does not take place, a bloody serous fluid oozes out from under the dressings, if the oppression of breathing should not render it necessary to remove them, and the patient is relieved by the discharge which takes place and which after a time, as the case proceeds towards recovery, will become less in quantity and more purulent in quality. If it should terminate in empyema, the principles of treatment are clear.

If the union of the divided parts should take place externally, and the general as well as local symptoms become more urgent, there can be little doubt of a collection of some kind having taken place, and it is now that auscultation and percussion, if it can be borne, become of the greatest importance. From the moment the wound is closed, and whilst the patient is awake, the stethoscope and the ear become the most important guides; the only ones in fact to be depended upon as to what is going on within the chest. The case is one of pleuritis, perhaps of pleuro-pneumonia, and hence the reason I have entered more fully on the symptoms and treatment of these complaints than might be considered to appertain to the province of surgery. It was because I knew that the fluid thus effused should be evacuated by the very small trocar and canula as soon as its existence in sufficient quantity to compress the lung has been ascertained by the stethoscope or the ear, that I dwelt on their use, and to the lectures which treat upon these points the surgeon must now turn for the desired information. This effusion of a bloody serous fluid comes on, after a penetrating injury, from the third until the seventh or ninth day, by which time the cavity of the pleura will in all probability be filled; and puncturing the chest between the sixth and seventh ribs at the point of election, must be resorted to for its evacuation.

Case 67.—A soldier of the third division of infantry, whilst under the command of Sir James Kempt, was wounded at Waterloo, by a straight sword or sabre, which penetrated the left side of the chest. He fell, and lost a considerable quantity of blood from the mouth as well as from the wound, and was supposed to be dying. On shewing some signs of life, the wound was covered by a part of his shirt, and on his arrival at the Elizabeth hospital in Brussels, four days afterwards, it was closed. On the ninth day, when my attention was drawn to him, he was sitting up in great distress, from difficulty of breathing, his hand pressed upon the wounded part, the cicatrix of which was red, swollen, and projecting. I recommended the assistant-surgeon in charge to open this with an abscess lancet, which he did, giving vent to a very large quantity of bloody and purulent matter, to the great relief of the patient for several days, although he did not ultimately recover.

Case 68.—In another and very similar case in the same hospital, my attention was drawn to the patient, in consequence of the wounded part having yielded by ulceration on the night of the eleventh day, the purulent discharge having been great. This man was also lost, principally from want of care in the first instance, and from too long delay in obtaining that relief which his case required, the necessity for which I have endeavoured to enforce.

Case 69.—A piquet of Portuguese infantry being surprised by a sudden rush of French cavalry from the town, during the first unsuccessful siege of Badajoz, previously to the battle of Albuhera, were nearly all sabred. Those who survived were brought to me. They had all received several wounds, and among them were two who had been run through one side of the chest, and one through both sides, which last died a few minutes after I saw him. The other two seemed to be nearly in a similar situation from loss of blood by the mouth and from the wounds. These were immediately closed by stitches, compresses, and adhesive plasters. A little hot brandy and water was given to each, and they were laid aside without hope of recovery, whilst attention was paid in turn to the others. They did not however die; the breathing became more easy, the distress less, the pulse more distinct; reaction after a time took place. The next morning, the siege being abandoned, they were removed to Elvas, where I heard they arrived safely in two days, apparently doing well.

The advantages derived from the closure of the wounds in these cases was manifest. It relieved the breathing, and caused the hemorrhage to cease, aided, in all probability, by the exhausted state of the patients. I considered the relief to the breathing to have been at the moment the most essential point gained; the wounds of entrance being near two inches long, and the free admission of air quite unopposed, the lung had receded from the opening.

In the *Lancet* for July, 1825, page 94, there is the case of a person wounded by falling on a spike, which penetrated the thorax, between the third and fourth ribs. The lung receded to the distance of six inches. The wound was kept open, and the patient died next day; in all probability from its having been so done.

*The important question of hemorrhage* remains for consideration in cases of incised wounds admitting of being accurately closed, which gun-shot wounds will not generally do. In many instances, the quantity of blood effused is trifling, and in others, although greater, it is absorbed without gravitating to the diaphragm, or being productive of evil. In a third class of cases, the quantity extravasated is larger than is likely to be absorbed, although it does not flow in an inconvenient or dangerous manner through the wound, and may ultimately become coagulated, and adherent to the diaphragm and spine in the angle between them, when the patient lies long on his back. In the worst or most alarming cases, the discharge is and has been so great that its suppression offers the only chance for the continuance of life. It is between these two last cases only that a difference of opinion has existed as to the treatment to be pursued, and it may be shortly stated: one party desiring that the effused blood, if moderate in quantity, should be allowed to discharge itself, the wound being kept open; the other, that under all circumstances, whether the quantity of blood poured out be small or great, the wound should be closed, and the result awaited. The right course perhaps will be, and it is the one I recommend, to remove all the blood which can be evacuated by position, provided it can be done without danger to the patient, before the wound is closed. A man under any of these circumstances must lose a quantity of blood before he recovers, and it is better not to allow it to fill the chest, if it can be prevented; but as the bleeding vessel in the lung cannot readily be got at if seen, and if got at cannot be secured by ligature with advantage, the only means left, if the bleeding continue, is to close the wound, and allow the cavity of the pleura to be filled, until the lung shall be sufficiently compressed to cause the hemorrhage to cease, if the person should survive so long. The closure of the wound is sometimes sufficient, by preventing the admission of air, to arrest the apparently departing life of the sufferer, and to give almost immediate relief. The decubitus should be in that position, under such circumstances, which may be most comfortable to the patient. The first object is to save life; after that, if time be given, the next will be to relieve the loaded cavity; but what time may be required by nature to render the suppression of the bleeding permanent, has not yet been clearly ascertained. Baron Larrey has supposed nine days, before the lapse of which time he thinks no attempt ought to be made to evacuate any part of it, or of the serous fluid which may be intermingled with it. On this point I venture to differ in opinion. After the wound has been closed, and the patient has so far recovered, that reaction has begun to take place, it may be concluded that the bleeding has ceased. The chest should then be most carefully auscultated from day to day, so that its respiratory state may be known, particularly that indicating the increase of effusion, which would then be serous. This will not take place until after the third, and not perhaps before the fifth or sixth day, in any considerable quantity; the wound should then be re-opened, or another opening made, at the most convenient place for the evacuation of the effused blood and serum. It is probable that the wound of the vessel in the lung which furnished the blood will be as safely closed in five days as in nine, whilst it is of great importance that this organ should be early relieved from pressure, that it should be allowed to expand, and not be bound down by false membranes, which will be the case if the compressing fluid be not removed, and the inflammatory symptoms subdued. There is no object to be gained but the suppression of the hemorrhage, by retaining the blood and serum poured out within the chest; the probability of a return of the bleeding is not great after an early opening has been made, although much mischief will inevitably follow the effused fluids remaining too long.

Repeated observation has shewn that in sabre wounds penetrating the chest and lung, which have not united, and from which no excessive hemorrhage has occurred, a great discharge of serous fluid usually takes place from the cavity, which, gradually diminishing, becomes purulent, and at last ceases, without the function of the lung being destroyed; whilst, if the wound had been early closed, and the fluid collected too long retained, the function of the lung will be impaired, and a counter-opening, which will be necessary for the relief of the resulting empyema, may be unavailing. I am distinctly, therefore, of opinion, that whenever the adhesive process between the pleuræ has failed, and great effusion has taken place, the sooner it is discharged the better. To ascertain the proper time for doing this when the wound is not open, requires great care and unremitting attention in the use of the stethoscope.

In addition to the closure of the wound, it is desirable to arrest the hemorrhage by other means, if possible, such as the abstraction of blood from the arm, to the utmost extent it may be considered the patient can bear; the administration of the acetate of lead with opium, or the mineral acids; and the external use of cold or iced water, if it can be borne. If there be reason to believe that a rib or ribs have been injured,—that any extraneous body is inclosed in the wound -or, from its appearance, that it will certainly re-open—an incision should be made in the part injured, for the purpose of giving the necessary assistance. The cure, however, will not only be assisted, but mainly effected, by procuring a depending opening. This may in some cases be accomplished by means of the small trocar and canula introduced as low down as auscultation and percussion will authorise; and the introduction of this instrument will give the desired information on one hand, and do little or no harm on the other. It is so important in cases in which any foreign substance or solid body may be supposed to be loose in the cavity, that the opening should be but little above the plane of the diaphragm, that much care and attention should be devoted to this point, and some risk, even, incurred.

CASE 70.—Dionis, in his *Operations of Surgery*, p. 418, relates the case of a soldier wounded by a sword in the breast, under the right nipple, whose chest had filled with blood by the time he was brought to him. He dilated the wound sufficiently to allow the blood to flow readily from it, and directed the patient to lie on the wound all night, so as to allow the blood to drain out. Finding the cavity empty next morning, he closed the wound, and the man rejoined the army, cured, in one month.

Dionis adds, that bleeding from it, is the only reason for not closing a wound in the chest as quickly as possible, and he is exceedingly zealous for making a counter-opening in a convenient place, when the wound is not favourably situated for the evacuation of the effused blood.

Le Dran, in his *Treatise or Reflections on Gunshot Wounds*, published in 1742 at Amsterdam, was aware of the inutility of everything, except the means adopted by nature, for the suppression of hemorrhage from a wounded lung, and advises therefore that the wound should be closed, in order that the bleeding might be arrested by the pressure of the blood effused, saying that the blood thus effused should only be evacuated when the oppression in breathing is insupportable, and then only in sufficient quantity to give relief, but not to favor, if possible, by the removal of the pressure, the recurrence of the hemorrhage. After a time, he adds, the whole may be evacuated, when the discharge will be purulent.

CASE 71.—A soldier of the third regiment of Infantry was wounded by a lance at the battle of Albuhera, in the left side, between the fifth and sixth ribs, and was thrown down, bleeding from the mouth and from the wound, which was afterwards closed by his comrades, by confining upon it a piece of his shirt folded up for the purpose. Brought to the hospital, at the village of Valverde, he appeared to be dying ten days afterwards, from difficulty of breathing. On examining the wound, which was slightly emphysematous and ecchymosed, a little coagulated blood was removed from it, and on enlarging the opening in the integuments, a quantity, partly fluid, partly coagulated, issued from the cavity of the chest. The wound was kept open to allow the discharge of a considerable quantity of reddish watery fluid, which, after a few days, became purulent. At the end of three weeks, I sent him to Elvas, doing well, and with but little discharge from the wound.

CASE 72.—A heavy dragoon, of the German Legion, was wounded at the battle of Salamanca, by a sword, which penetrated the cavity of the right side of the chest, between the sixth and seventh ribs; he fell from his horse, and lost a considerable quantity of blood from the mouth and from the wound, which last was stopped by pressure made upon the external opening. Brought to me at the field hospital next day, I found that he had recovered from the immediate effects of the injury and loss of blood, although greatly oppressed by difficulty of breathing. On examining the wound, a black coagulum was seen filling up the orifice, the cellular membrane around being considerably ecchymosed, and little doubt existed that the oppression was caused by blood effused into the cavity. On removing the coagulum, and separating the edges of the wound by a director, several ounces of blood, half-fluid, half-coagulated, were readily evacuated, this object being assisted by turning the patient, so as to make the external opening, which was enlarged, quite dependent. When the discharge had ceased, the lung was seen in contact with the external opening of the wound, having expanded as the pressure of the blood was removed from it. As no fresh blood issued, it was evident that the bleeding from the lung had ceased. The wound was now closed simply, by lint, compress, and adhesive plaster, without bandage; he was largely bled, and placed upon his wounded side on the ground, as comfortably as circumstances would permit, and in some degree relieved from the oppression in breathing. Two days after, the wound discharged freely a reddish-coloured watery fluid, evidently from the cavity of the chest, the exit of which was aided by keeping the wound generally dependent. This continued for several days, gradually becoming less in quantity, and purulent; and under careful management he was able to go to the rear, nearly well, by the end of October.

Case 73.—A French cavalry soldier was wounded at Waterloo, by a sword thrust into the right side of the chest, between the fifth and sixth ribs; the wound bled largely, and he also spat up a great deal of blood. The bleeding from the wound was stopped by binding various articles of dress upon it, and he remained five days on the field of battle. On his arrival in the hospital at Brussels, he was bled, and treated systematically for several days. The wound had closed, but the oppression in breathing increased; and I saw at once, from the smoothness of the chest, the filling up of the intercostal spaces, and the bulging of the cicatrix, that the chest was full of fluid, and recommended an incision to be made into it, through which three or four pints of bloody fluid were evacuated, to the great relief of the patient, who nevertheless ultimately died.

Valentin, whose "*Recherches Critiques sur la Chirurgie Moderne*," published at Amsterdam in 1772, to which I have already alluded, and which have frequently been noticed by writers on injuries of the chest, has not received the credit due to him from any of them. He was among the first to declare that all wounds of the chest should be immediately closed, for the purpose of suppressing hæmorrhage; that a counter opening should be made, if necessary—and made early for the evacuation of the effused blood—and that in such cases, the effusion of a quantity of blood would be known by an ecchymosis formed over the angles of the ribs. The recommendations of Baron Larrey, and those of others as well as my own, add nothing to what he had already said; they have only enforced what had been neglected. He supported his opinions by impugning the practice of Pechlin, often quoted as Pechlinus, in a particular case, which had been precognised as one so exceedingly successful as to induce Baron Haller to give it a place in his collection of remarkable cases, and it was considered as a model to be followed in future.

Case 74.—A student was wounded by a sword on the 4th of May, 1679, between the fifth and sixth ribs. Pechlin finding him in a faint and almost dying state, gave him a cordial, and as no blood flowed from the wound, a tent was introduced. Four hours afterwards the oppression and pain being increased, the tent was removed, and twelve ounces of frothy red blood were evacuated. The tent was re-introduced. There was neither cough, nor spitting of blood. The 5th May, twenty-eight ounces were let out at twice. On the 6th, he was bled; twelve ounces of blood were removed by the wound, and a piece of bougie introduced. 7th. Fever; cough; dyspnœa; oppression: thirteen ounces of blood removed in the morning; at six in the evening, a small astringent injection into the chest. On the 8th, the fifth day from the accident, four ounces of blood were evacuated. On the 9th, fourteen ounces, and in the evening twelve ounces more, and frothy, were discharged from the wound with great difficulty. Between this and the 20th, one hundred and forty ounces of blood were evacuated, the discharge being the last ten days also purulent, and at last four ounces of pus only. From the 20th to the 30th, pus only was discharged; the patient then began to recover, and by the 31st of July he was cured.

Valentin, commenting on the treatment pursued in this case, declares that the repeated hæmorrhages, and other bad symptoms, depended more on the tents introduced by the surgeon, on the dressing, and on the means employed, than on the nature of the mischief done to the parts; and that if instead of keeping the wound open by a tent, they had allowed it to close, and had made a counter-opening in the chest at the place of election, when the symptoms of effusion appeared to require it, the patient would have escaped with much less suffering. He then relates the following case from Smetius in support of his opinion. A soldier received a wound between the sixth and seventh ribs below the nipple, which, at the end of nine months, became fistulous, and placed him in the greatest danger, until he put himself under the care of John Walardin, one of the ablest surgeons of his time, who decided on making an opening into the chest below the wound. This he did, and having broken down an adhesion between the lung and the wall of the chest, he evacuated a pint of matter, and removed the same quantity every day for four days. After the fifth day he injected a mild lotion, and the patient soon recovered.

On the subject of the ecchymosis, which he considers to be a pathognomonic sign of effusion of blood within the chest, he says, "It is very dissimilar to that which occurs after a blow or wound, and which takes place shortly after the accident, beginning around the wound if there be one, and extending from it. The patient also complains of pain, when the bruised part is pressed by the fingers. These characters are not observed in the ecchymosis, the sign of effusion, which always takes place near the angles of the lower or false ribs descending towards the loins. Its colour is identical with that which appears on the abdomen of persons some time after death, a bright violet (violet trés eclairci). It appears about ten days after the receipt of the injury, sometimes later." The same sort of thing he thinks takes place when the cavity of the chest is filled with pus, but this œdematous swelling is without discoloration.

Sabatier, in his *Médécine Operatoire*, 1822, edited by Sanson and Bégin, comments upon the opinion of Valentin, and relates the following case communicated to him by M. Saucerotte the elder. A carbineer was wounded by a sword on the right side of the chest, below the tendon of the great pectoral muscle, and appeared to be going on satisfactorily until the fifth day, when he complained of general uneasiness, difficulty of respiration, and inability to lie on the left or opposite side; he also suffered great pain in the upper part of the shoulder and region of the liver. These symptoms increased until the ninth day, when he could only obtain relief by leaning towards his right on a chair placed across the bed. This assemblage of symptoms induced M. Saucerotte to believe that a considerable quantity of blood was effused into the cavity of the chest, but as the ecchymosis of Valentin did not appear, he delayed making an incision, and the man died the same night. An incision having been made into the dead body, allowed the evacuation of a quart of putrid blood.

This ecchymosis appears to be at all events a late symptom, not occurring before the first ten days, and not always to be depended upon; it should in general be anticipated by an opening into the chest, auscultation and percussion now offering, at an earlier period, more certain diagnostic signs of the existence of the extravasated blood, than the ecchymosis.

Case 75, by Baron Larrey; *Memoire sur les Plaies, &c.*, Academie Royale de Medicine, tome 1, p. 242.—A. C., 26 years of age, was wounded by a sword, which entered the chest a little to the outside, and below the right nipple, the point passing out in the bottom of the arm-pit between the third and fourth ribs, and dividing the latissimus dorsi muscle, near its insertion into the humerus. He lost a considerable quantity of blood, and was supposed to be dying. The next morning, on enlarging the wound, the fingers passed easily into the cavity of the chest. The intercostal artery was supposed to have been wounded, but the hemorrhage had ceased. From the wound in the lung, however, a quantity of red frothy blood still continued to ooze. The cut edges of the wound were brought together by compress and bandage; the chest, belly, and limbs, were well rubbed with hot camphorated oil, and enveloped in flannel. In the evening he could speak, and there could be little doubt that the internal hemorrhage had ceased. On the night of the second day, symptoms of inflammation having declared themselves, the patient was largely bled, and slightly cupped with points, over the hypochondrium; he expectorated during the night a quantity of black blood. Respiration was less laborious, the pulse soft; the wound had nearly united; on the fourth day he eat some bread and meat contrary to orders; was immediately taken ill, and threw up by the aid of some nauseating drink what he had swallowed. In a short time afterwards he became greatly oppressed, lost his speech, could scarcely breathe, and appeared about to die of suffocation. The wounded side of the chest was distended, and the pulse could not be felt. It was supposed that the hemorrhage had been re-produced by the vomiting. The chest was dry cupped and iced, acid drink given until the morning of the fifth day, when an opening was made into the cavity of the chest, between the eighth and ninth ribs behind, and about ten pints of fluid evacuated of the colour of wine lees mixed with clots of blood; the cavity of the pleura being carefully emptied by the aid of a gum elastic catheter, after which a small band of oiled linen was introduced, and the wound dressed in the ordinary way. On the sixth day, an elastic tube being introduced, a pint of bloody serous fluid was discharged. The wound was dressed twice a-day. The tent was retained in the wound for ten days; the discharge then became purulent, and came freely from the wound, which remained open. After many disasters, after every appearance of phthisis, of consecutive diarrhœa, &c., the patient gradually recovered at the end of ten months. Eight years afterwards the right or wounded side of the chest was found to be less by one half than the left. The ribs had lost a great part of their curvature, the shoulder was lower, the trunk bent to that side, the heart turned to the right, and its pulsations were felt opposite the cartilages of the eighth and ninth ribs. The left side of the chest was enlarged in a corresponding degree, and respiration was effected by this lung only. The arm of the affected side was atrophied; but the health under all these changes was good.

It may be remarked on this case, that there can be little doubt that the vomiting which took place on the fourth day gave rise to effusion into the cavity of the pleura, and not to a renewal of the bleeding, as was supposed by the Baron; for if it had been blood which had been poured out, he would not have evacuated next day ten pints of a serous bloody fluid, that effusion being the consequence of inflammation taking place rapidly—a result in these cases always to be expected, and for which the surgeon should be prepared. The falling in of the chest was the consequence of the inability of the lung to expand.

Case 76.—Baron Larrey has also related the case of a soldier, twenty-two years of age, who, being wounded on the right side of the chest by a sword, had on the third day the ecchymosis of Valentin, and the other symptoms of extravasation. On the night of the sixth, a severe paroxysm of fever took place, followed by a copious critical fœtid sweat, after which the signs of effusion diminished, and the man recovered at the end of three months. The extravasation of a large quantity of blood may in this case be doubted, although the ecchymosis was present.

The Baron has so effectively supported the views promulgated by Valentin, but which had been previously practised by La Motte and Ravaton, that the introduction of the practice has been attributed to him, but which, as I have shewn, is an error; for although the precepts of Valentin may have been forgotten in France, they were in existence, but the Baron has the merit of having revived and confirmed them. In pursuing the same course, long before I had seen any of his works, I was not aware that I was acting out of the ordinary course of things, with the trivial exception of sewing up the skin of the wound by the continuous suture instead of trusting to a compress and bandage.

In order to be explicit on points so important as those of which I have treated, I have thought it right to lay down certain general conclusions, subject to occasional deviations.

1. All *incised or penetrating wounds* of the chest should be closed as quickly as possible, by a continuous suture through the skin only, and a compress supported by adhesive plasters, the patient being afterwards placed on the wounded side.

2. If blood flows freely from a small opening, the wound should be enlarged, so as to shew whether it does or does not flow from within the cavity. If it evidently proceed from a vessel external to the cavity, that vessel must be secured by torsion or by ligature.

3. If blood flow from within the chest, in a manner likely to endanger life, the wound should be instantly closed; but as the loss of a reasonable quantity of blood in such cases, say from two to three pounds, will be beneficial rather than otherwise, this closure may be delayed until syncope takes place, or until a further loss of blood appears unadvisable.

4. If the wound in the chest have ceased to bleed, although a quantity of blood is manifestly effused into the cavity of the pleura, the wound may be left open, although covered, for a few hours, if the effused or extravasated blood should seem likely to be evacuated from it, when aided by position; but as soon as this evacuation appears to have been effected, or cannot be accomplished, the wound should be closed. It must be borne in mind that the extravasation which does take place is usually less than is generally supposed—a point which auscultation and percussion will hereafter in all probability disclose.

5. If auscultation and percussion should indicate that the cavity of the pleura is full of blood, and the oppression of breathing and the distress are so great, as to place the life of the patient in immediate danger, the wound, although recent, should be re-opened, as in Cases 56, 57, and 72.

6. As soon as the presence of even a serous fluid in the chest is ascertained to be in sufficient quantity to compress the lung against the spine, and time has been allowed for the closure of the vessel from which blood originally flowed, a counter-opening should be made in the place of election for its evacuation by the trocar and canula, which may be afterwards enlarged, unless the re-opening of the wound should be thought preferable, which will not be the case unless it should be low in the chest.

## LECTURE X.

*Gun-shot Wounds of the Chest, penetrating the Cavity, always dangerous; Dr. Gregory's inferences erroneous, as to the results at Quebec; Results after the Battle of Toulouse; Of Menière, at Paris, in 1830; Of Hippolyte Larrey; After Waterloo; On the Sutlej; Appearances of Orifices of Entrance and of Exit; Symptoms; Balls said to Run Round; Peculiarities of; Cases of; Balls Rebound from the Sternum; Lodge in it; Removed from the Mediastinum; Mr. Stanley's Case; Ravaton's; Mr. Guthrie's Case; Balls impacted between the Ribs, with Fracture of the Bones; Enlargement of the Gun-shot Wounds, for the Extraction of the Ball; Case of Hali Chaoux; Percy, Sorbier, and Gerard's Cases; Enlargement of the Wound in Cases of Fracture of Rib by Musket-ball; Mr. Guthrie's Case; Extraction of Splinters; Imbedding of Splinters, &c., in the Lung; Extraction of Balls impacted between the Ribs; Injury of the Costal Cartilages; How to Replace the bent portion; Balls striking obliquely run round the Chest; Consequences of this kind of Injury; Mr. Guthrie's Case; Character of the Gun-shot Track through the Lung, and its Symptoms; Beneficial Effects of previous Adhesions; Mr. Guthrie's Cases; Case of Sir Lowry Cole; of Sir Andrew Barnard; of Col. Broke; of the Duke of Richmond; of Mrs. Magnus; Comments on these Cases; Cases in which the External Opening does not communicate freely with the Cavity of the Chest; Cause of Death from Pistol-shot Wounds in Duels; Effusion of Red-coloured Serum into the Chest; Case of Sir Charles Bampfylde; Mr. Guthrie's Cases; M. Scharf's Case; Penetrating Wounds, followed by Suppuration and Recovery, with some Alteration of the Size and Appearance of the Chest; Cases of the Marquis D'Harcourt, Major Gillies, Lieut. Forder, Major M'Gibbon, Captain Cane, &c.; Diemerbroeck's Case; Cases from the Indian Battles; Mr. J. R. Taylor's Case; Dr. Williamson's Cases; Case of Lieut.-Colonel Dumaresq; Mr. Collins' Case; General Macdonald's Case of the Bombardier.*

*Gunshot wounds of the chest,* penetrating the cavity, are always exceedingly dangerous. It has been said by one writer, and it has been repeated by others, that the late Dr. Gregory, of Edinburgh, was in the habit of stating in his lectures, that of twenty-six wounds of the thorax received at the battle of Quebec, two only proved fatal. This statement being contrary to every known fact of the kind, since that period, cannot be relied upon, and must have reference to those cases only, which were received into hospital some days after the battle, and after the worst had died. After the battle of Toulouse, on the 10th of April, 1814, one hundred and six cases of wounds of the chest in officers and soldiers, in all of whom the cavities were not opened, were received into the hospitals in the town. Between the 12th of April and the 28th of June, thirty-five died; fourteen were discharged to duty, and fifty-seven were transferred to Bordeaux, to proceed to England, some to die, some to be pensioned, but few in all probability to return to the service; being an ultimate loss, I have little doubt, of nearly one-half, if the fifty-seven cases sent to England could be traced. I have seen eight cases of pistol shot, through or into the chest, in London, although all were not under my care; of these two only recovered. M. Menière, in giving an account of the wounded carried to the Hotel Dieu, of Paris, in the three remarkable days of July, 1830, where every case was immediately taken care of, says forty cases were received into the hospital; of these twenty died, whose names and the nature of whose wounds he states; he names and states the cases of ten more, seriously wounded, who recovered, and he gives the names of seven more, in six of which the cavity of the chest was not perforated; and alludes to three wounded by small swords, who recovered; the loss being thus one half, even if the rest happily and perfectly recovered, which may be doubted; thus shewing that with the ablest assistance the Hotel Dieu of Paris could afford, the loss was one half. M. Hippolyte Larrey at the hospital of Gros Caillou, lost only one in thirteen, but it is admitted that the slighter cases only went there from its distance, the most serious being taken to the Hotel Dieu. I lost in charge of the wounded even at Toulouse, one in three, and I do not apprehend it will ever be much less, unless the improvements in surgical science should be more important than can be reasonably expected. After the battle of Waterloo, the loss was much greater; with the army on the Sutlej, it was so great, as to be a matter deserving the most serious consideration, and I reserve this point for particular explanation.

When a musket ball fairly passes through the cavity of the chest, the orifice of entrance is usually round, depressed, dark-colored, and more or less bloody in the first instance; the orifice of exit is generally more of a rugged slit or tear, than a hole. The alarm is great, and the powers of life are depressed to a greater or less extent; the wounds may or may not bleed; the sufferer may spit up more or less blood; respiration may be difficult;

countenance pale, extremities cold, pulse variable; all these symptoms being dependent on particular constitutions, and circumstances connected with the nature and extent of the injury inflicted.

It has been said that balls are apt to run round the body, coming out at a point opposite to that at which they entered, without penetrating the cavity of the chest;this, whenever it does take place, must be considered as a rare exception to a general rule, more talked about than seen; although it does sometimes happen, when the ball is reflected off something solid which it cannot penetrate, such as a button, a piece of money, a rib, &c. If the ball runs under the integuments exterior to the fascia covering the intercostal muscles, it is usually marked by a tenderness in its course on touching it, and a discoloration of the skin. A ball may, however, run between two ribs for some distance, injuring the muscular structures between them, without penetrating the cavity, in which case, after the first moments of alarm have passed away, the symptoms indicative of a penetrating wound, either cease or do not occur, although those of inflammation of the pleura or lung, may, and often do follow, to a considerable extent.

Case 77.—A private of the 23rd Regiment, was wounded at Albuhera, by a musket-ball which struck the button of his coat, a little to the inside of the nipple of his right breast, glanced from it between the ribs, and came out nearly opposite behind, running a course about one-third round the body; some of the coat and flannel waistcoat stopped half way, and gave rise to inflammation and swelling, requiring an incision, which revealed the exact nature of the injury.

In other cases, the presence of the balls, their subsequent extraction, and the absence of urgent symptoms demonstrated the deviations which had taken place. When the ball cannot be traced, the absence of symptoms, after the first period of alarm has subsided, will enable the surgeon to form the surest prognosis; their absence is, however, somewhat deceptive, and cannot too certainly be relied on.

A ball will occasionally rebound from the sternum, leaving merely a black mark; I have removed some without difficulty, from the spongy nature of the bone in which they had lodged, and one by the application of the trephine, ineffectually as regards saving life. Some surgeons have been fortunate enough to follow and remove them from the anterior mediastinum. I have never been able to trace them beyond the sternum, except after death. Mr. Stanley informs me there is a sternum in the museum of St. Bartholomew's Hospital, with a ball encased on the inside of it, nothing being discovered to indicate the track which it had taken. If a ball should be distinctly felt, through a wound in the sternum, the broken portions of bone should be removed by the small saw or by the trephine, and the ball extracted, but this operation should not be done experimentally, or without a good foundation for it.

Case 78.—Ravaton relates a case, page 216, of an officer wounded by a pistol-ball, which penetrated the upper and right side of the sternum, and caused great apprehension of its being lodged in the chest. The wound in the bone being small, the trepan was applied, when the wadding of the pistol and some pieces of clothes were found immediately underneath, and two ounces of blood were discharged by leaning to the right side. The patient wavered between life and death until the thirteenth day, when the ball appeared at the wound, and was removed. The wound was injected, and Ravaton thought the cavity of the chest also; but it would seem to have been merely the mediastinum, in which a fistulous opening remained at the end of nine months, when he left the hospital.

Case 79.—A soldier of the battalion of detachments, was struck on the hill of Talavera, when driven off it by the French the evening before the battle, and came to me; the ball having penetrated the skin, was lying between the ribs, in the intercostal space, embedded in the muscles, whence it was removed by the aid of an incision. He recovered perfectly, but not without some loss of blood.

When a ball strikes the side or back of the chest, where the ribs approach nearer to each other, it may be impacted between them, usually fracturing one or other, and causing some difficulty in its removal. These are usually considered fortunate wounds. I have extracted several such balls with successful results, although these injuries are generally followed by active pleuritic inflammation.

It has been a question whether gun-shot wounds should be enlarged, and the advocates of this proceeding in all other parts of the body admit that it should be done here with caution, and to less extent than in any other place. A division of the external parts, the "*debridement*" of the French, answers no good purpose that I am aware of, although it does no harm beyond the pain it occasions, unless there is something to be removed; when it ceases to be a mere "*debridement*," and becomes an incision for an especial purpose, absolutely necessary in many instances, for the removal of extraneous bodies or for the evacuation of blood, &c. The principle I apprehend to be, that, when a wound from a musket-ball appears likely to have penetrated the cavity of the chest, and is too small to admit the end of the finger, it ought to be enlarged, so as to allow of its introduction as far as the ribs, in order to ascertain whether these bones have sustained any injury, or anything is lodged exterior to or within them. I only object to a man being cut simply because he has been shot; but not when done for any apparent or well-founded supposition; but these enlargements of the wound should be of no greater extent than is absolutely necessary for the purpose intended. When pieces of shell, or of swords or lances, are broken off, and partly lodged in the cavity of the thorax, which is more likely to happen when they enter through the large muscles of the back, they will require larger incisions to give room for their removal, in doing which I have found no difficulty. Remont de Vermaille, in his *Observations on Surgery*, p. 126, relates the case of Haly Chaoux, a Turk, from whose back he extracted with difficulty six inches of a dagger, which had penetrated his diaphragm and kidney. Percy mentions a case in which seven inches of a small sword were broken short off, and not discovered until too late, having penetrated the chest and lung, and lodged in the fourth dorsal vertebra. Sorbier extracted the point of a small sword, which stuck in a rib. The greatest applause was, however, given of old to Gerard, surgeon in chief of the Charité in Paris, who, perceiving that a small sword, after going through a rib, was broken off close to it, thought it advisable to make an incision through the intercostal muscles into the chest, and then to introduce his fore-finger, armed at the end with a thimble, with which he pressed back the point of the broken blade. It is to be presumed that Mons. Gerard took care to hold on by the thimble in some way or other, that it might not slip off by accident; and the whole process would in modern times be, perhaps, more honoured in the breach than in the observance; although the Baron Percy does say that it was one of those imprescriptable resources which true genius alone has the right to suggest. In a case of this kind the surface and outer edge of the bone should be removed, until the piece of steel could be firmly seized and held by a fine pair of pincers or plyers.

When a ball sticks firmly between two ribs, it requires some care to remove it, as the rib both above and below may be more or less interested, although not actually fractured; this occurs especially when the injury is in the back near the spine, where the ribs are closer to each other. The attempt should be made during inspiration, when the lower rib should be depressed, and some thin, but not sharp-pointed instrument like an elevator should be gently pressed around and under the loosest edge of the ball, in order to extricate it—a proceeding which has never failed in my hands.

When a musket-ball fractures a rib, there ought to be no hesitation about the propriety of enlarging the wound, if it should not be already large enough to allow the splintered portions of bone to be removed. It is possible that in doing this, some pieces of cloth or other matters may be extracted, which might glide into the cavity of the thorax, or stick in the lung itself.

Case 80.—A soldier of one of the regiments on the left of the position of Talavera, was brought to me, wounded by a ball in the left side of the breast, which had struck the sixth rib, going out about four inches nearer the back. As the point of the finger indicated the presence of broken bone, I enlarged the anterior wound, and then found that the ball had driven some spiculæ of bone into the surface of the lung, which appeared to have been previously attached to the pleura costalis at that part. These being removed, together with a piece of coat which had been carried in with the ball, left a small, clear wound, which gradually healed up, the man accompanying me on the retreat over the bridge of Arzobispo.

In all cases in which fractured parts of a rib are driven inwards by a musket or pistol-ball, it is advisable to see the broken portions or ends of the rib; the additional external opening in this case does no harm, even if it be of no particular service. The wound in the pleura should not, however, be enlarged, unless for a special reason, inasmuch as the entrance of air is as much as possible to be prevented, in order to avoid its causing a compression of the lung; but this is also of comparatively little importance after the first few days, if adhesions between the parts should not have taken place.

When a ball impinges with force on the centre of one of the ribs, and passes into or through the chest, the bone is usually broken into several splinters of different lengths, some of which frequently accompany the ball in the commencement of its course, or are even carried into the substance of the lung, together with a part of the wadding of the gun, or the clothes of the patient. These should if possible be early removed, and the sharp ends of the ribs rounded off. When the ball fractures a rib on passing out of the chest, the splinters are driven outwardly.

When a ball strikes a cartilage of one of the ribs, it does not punch out a piece as it were, but merely divides and passes through it, bending it inwards, but rarely tearing away a portion. The parts of the cartilage thus bent and turned inwards are easily drawn outwards, and replaced by the end of the finger, a bent probe, or other curved instrument.

A ball when striking obliquely, but with force, on the chest, will frequently penetrate, and then run round, between the lung and the pleura lining the wall of the chest, for a considerable distance, before it makes its exit. In this case the lung may be only slightly bruised, without the pleura pulmonalis or costalis being more than ruffled. In others the lung shews a distinct track or hollow made by the ball. A shade deeper, and the ball penetrates, and forms not a hollow, but a canal. I have often had occasion to suspect injuries of the first kind. The patient in all spits blood, and the first symptoms are severe; they usually however subside, and are not always followed, under proper treatment, by effusion.

Case 81.—A soldier of the battalion of detachments was brought to my hospital, after the battle of Talavera, shot by two balls, one in the abdomen, one in the chest, and died next day of inflammation of the abdomen. I examined the chest, and found that the second ball had entered between the fifth and sixth ribs on the right side in front, and had gone out near their angles, having run between the lung and the pleura costalis, doing little more than marking both as if slightly bruised.

When the ball fairly passes through the lung, it makes a canal through it more or less bruised and bloody, and which continues for a time to bleed more or less according to the size of the vessels which are injured, thus making a wound more dangerous as it approaches the root of the lung where the vessels are largest. In the generality of cases, blood is spit up, or if effused it gravitates in the chest, until it rests on the diaphragm or other most depending part according to the position of the patient. If it should be in quantity, the filling up of the chest may be ascertained by percussion and by auscultation, although the wound should be closed. As the quantity of effused blood increases, the lung becomes more and more compressed, until at last the hemorrhage ceases under pressure, from the closure of the wound; and the patient is saved for the moment, unless he should die of asphyxia, from the lung of the other side being also compressed, through the bulging of the mediastinum on it. If the person wounded shall have suffered formerly from inflammation, and the lung has adhered in consequence to the wall of the thorax, at the parts where the ball enters and goes out, the cavity of the chest will not be opened, and the track only of the ball will communicate with the external parts, and the man to whom this happens may consider himself fortunate, unless the ball shall have perforated some of the large vessels, when he will continue to bleed by the mouth, the external wound being closed, and its passage outwards thus prevented. The pressure of the blood effused into the track of the ball, and which may become coagulated, will sometimes suffice, under even these circumstances, to suppress the hemorrhage which the loss of blood, the faintness of the patient, and the weakness of the circulation, under proper treatment, will materially assist in rendering permanent.

The following cases are instances of balls passing through the upper part of the chest, treated with sufficient care and attention from the first, to indicate what course these wounds will frequently take under such circumstances.

Case 82.—General Sir G. Lowry Cole, G.C.B., was struck at the battle of Salamanca, on the 22nd of July, 1812, by a musket-ball, which entered immediately below the clavicle, fractured the first rib, and inclining inwards, came out through the scapula behind, and as he spat blood for three days, the upper part of the lung was shewn to have been injured. The ball appeared to have passed so close to the under part of the subclavian artery, that the greatest fears were entertained for its safety, more particularly as a marked difference in the size of the pulse was perceived in the left arm, which I knew did not exist before. He remained three days on the field of battle, in a Portuguese officer's tent I always carried with me, and under repeated bleedings, and the strictest antiphlogistic treatment, several splinters coming away, and a large piece of the rib and of the scapula exfoliating, he gradually recovered, so as to be able to resume the command of the fourth division in October at Madrid. The subclavian artery never resumed its power, and the radial always beat less forcibly on the left side. He perfectly recovered his health, the respiratory murmur of the lung being natural. He died in 1844, from rupture, I believe, of an aneurism of the abdominal aorta.

Case 83.—A dragoon of the King's German Legion, shot in a nearly similar manner on the same occasion, suffered more severely: the clavicle and first rib were splintered to a greater extent, and he lost a large quantity of blood by the mouth. The splinters having been removed, after enlarging both wounds for that purpose, and the inflammatory symptoms subdued, he appeared to be going on favourably for three weeks, when having eaten some meat obtained irregularly, he suffered what seemed to be a bilious attack of vomiting and purging, attended by fever and oppression in the chest; an ipecacuanha emetic having been given, with full effect, relieved him much; during the efforts to vomit, the wounds discharged a quantity of sero-purulent fluid, which had in all probability been lying on the diaphragm, and a piece of the cloth of his coat, and another of bone, which had gone in with the ball, and in all likelihood had been lying with the matter at the bottom of the chest. After this he slowly recovered. Ravaton, p. 202, 1758, gives even a more remarkable case of a similar kind.

Case 84.—Lieut.-General Sir Andrew Barnard, K.C.B., was wounded when in command of the Rifle Brigade, at the passage of the Nivelle, on the 10th Nov. 1813, by a musket ball, which entered between the second and third ribs, in front of the right side of the chest, passed directly through the cavity and through the shoulder blade, from under the integuments covering which it was removed. He not only felt but heard the sound of the ball as it struck him, and fell from his horse. Blood gushed from his mouth, and continued to do so until after he was completely exhausted by bleeding from the arm to the amount of two quarts. He was again bled at night, and the subsequent morning, which relieved all the material symptoms. During six weeks he suffered from difficulty of breathing and cough, and from night sweats. Some pieces of bone and cloth came away from the wounds, with a free discharge in the first instance, which gradually diminished until the wound closed. In eight weeks he was able to resume his command.

Now, thirty-four years afterwards, the lung is pervious, and the vesicular murmur can be freely heard even up to the situation of the wounds, to the internal parts of which it may be concluded the lung adheres from the sound conveyed to the ear on auscultation. His health is otherwise good, and he has since suffered little or no inconvenience from the wounds.

Case 85, related by Col. Broke.—Towards the close of the battle of Orthez, on the 27th Feb. 1814, a musket shot struck me between the second and third ribs on the right side, near the breast-bone. I was then on horseback, being aide-de-camp to Lieut.-General Sir Henry Clinton, commanding the sixth division. The sensation was precisely as if I had been struck a violent blow with the point of a cane, but it did not unhorse me. I was attended in a very short time by the surgeon of the 61st regiment, when, on removing my clothes, the air and blood bubbled out from the wound as I drew my breath. The surgeon, turning me on my face, discovered the ball to be lodged under the thin part of the blade-bone. This he cut through and extracted the ball, and and with it pieces of my coat, waistcoat, and shirt, which were lodged between the ribs and the blade-bone. This occurred about four p.m. I was then removed to the town of Orthez, a distance of about three miles, and in the course of the afternoon, the veins of my arms were opened in at least seven different places, but scarcely any blood came away; breathing became, in a day or two, exceedingly painful, and I felt nearly suffocated, when, in the evening, my brother, Sir Charles Broke Vere, arrived with my friend, Mr. Guthrie, who examined me, and asked how I felt; I replied that the agony of drawing breath was such that I could scarcely endure it. He then opened one of the temporal arteries, and desired that it might be allowed to bleed without interruption. He afterwards left me, to visit some other wounded men, and returned in about three hours, when I told him that I felt relieved, and had much less of the suffocating pain in breathing. He then opened the other temporal artery, directing as before, that its bleeding should not be checked. I shortly after that dropped asleep, and, on waking, could breathe freely; and my recovery was, from that time, progressive, the wound in front, where the ball entered, being the first closed; but both were healed at the end of about eight weeks, and in about ten I was able to re-join the army at Bordeaux.

July 9, 1846. H. G. Broke, *Colonel.*

He is now, 1848, in perfect health; respiratory murmur free all over the chest.

Case 86.—The Duke of Richmond, then Earl of March, was wounded by a musket-ball at the battle of Orthez, Feb. 27th, 1814; while at the head of his company, in the 52nd light infantry. He was standing, at the moment, with his right side towards the enemy. The ball entered that side of the chest, between the fourth and fifth ribs, nearly in a line with the lower edge of the scapula. His lordship fell to the ground with great violence and was speechless for some time.

He, at a future period, stated to me that the sensation he felt at the moment, was, as if he had been "*cut in two.*"

On immediate examination there was no other opening to be found, but the *one* where the ball had entered;—nor were the medical officers (two or three being very soon on the spot,) able to feel the ball anywhere, under the skin, or under the muscles.

The wound having been dressed he was laid on a door; I was ordered to take charge of his lordship, and to remove him forthwith to the town of Orthez, about three miles from the scene of action; during which he complained of excruciating pain, extending from the wound to the top of the os ilium on the same side; the pain much aggravated by frequent and severe cough, with copious expectoration of frothy mucus, and much florid blood; his respiration hurried; countenance pale.

The moving him to Orthez occupied nearly three hours; a great part of the ground being very rough and broken, the men could not well step together, and the consequent unavoidable shaking and jolting caused much pain. On his arrival in Orthez, he was extremely languid, with a tendency to syncope. Pulse feeble; extremities rather cold.

Seven in the evening: After having been faint for an hour, he became hot and restless; pulse 108, and full; skin more hot; and the respiration short, and more hurried. After he was placed in bed, hemorrhage from the wound, to a very considerable extent, took place.—Eight ounces of blood were now taken from the arm. (Could bear no more.)

15th inst. A.M.: After the bleeding he became more quiet, and had less pain; but he has again become very restless, and the pain returned, with a full, hard, and frequent pulse. The wound has again discharged a very considerable quantity of blood. V. S. repeated as before.

Nine P. M.: Deputy-Inspector Thomson, and Staff-Surgeon Maling, in my presence, examined the wound. Mr. Maling introduced his finger (the whole length) between the ribs, into the wound, without any interruption to its progress, and without being able to reach the termination of the passage of the ball; and Dr. Thomson then passed a probe (its whole length) straight into the chest, with a similar result; thus leaving no doubt on the minds of all present that the ball had passed directly into the posterior part of the chest, and consequently causing much serious apprehension for the fate of the patient; more especially, as on a *farther search* for the ball, by all present, its place of lodgment could no where be detected.

The principal medical officer reported, I believe, to the Duke of Wellington, that, "if the Earl of March were King of England, there was little or no probability of his being saved."

Midnight: The blood last taken is very buffy; and there has again been an *immense discharge* of blood, &c., from the wound; the sheets, mattresses, &c., are saturated with it; and on the floor, under the bed, there is a large pool of blood which had soaked through the bedding. Pulse 114, low and full; frequent cough, and expectoration as before; violent pain and great restlessness. Rept. V. S.

*Mem.*—Perhaps enough has now been stated to shew the nature of the wound; and any further detailed statement of his lordship's sufferings, or the treatment of his case, would be unnecessary. On the latter point, however, it may be mentioned, that, exclusive of the *general treatment*, he was bled *seven times*, between the evening of the 27th February, and the morning of 2nd of March; the *cough, expectoration, breathing, pain, &c.*, being much relieved by each bleeding.

A. Hair, M.D.

I saw the Earl of March on the same day as Colonel Broke, and suggested that no further efforts should be made to find the ball, whilst the treatment adopted should be steadily pursued. In 1846, I pointed out the ball under the edge of the base of the scapula, where I had always supposed it to be, it having approached nearer to the surface. His Grace is now in good health, and the chest well formed, sounds clearly and soundly in every part, even at the point injured. G. J. G.

That the inflammation of the pleura in the preceding cases did not extend over the whole surface of the membrane, will, perhaps, be conceded, or, if it did, there is every probability that it ended in resolution rather than in an effusion of fluid, and the formation of matter and of false membranes agglutinating the pleuræ to each other; a result which does not follow in the generality of such cases, the pleura only adhering in the vicinity of the wounds. The size of the opening may also have allowed the evacuation of the extravasated blood and the fluids which might have been secreted, and may thereby, perhaps, have prevented further mischief.

The ball, in passing through the lung, in these cases, destroyed the life of that part only which it touched, and although air would pass out at the time, this effect would not be of long continuance; and as the wounds were kept covered, if not quite closed, the lung did not and does not collapse or recede from the wall of the chest, but quickly recovers its state of expansion, however impaired it may be at the moment by the injury. The track made by the ball gradually suppurates and heals, leaving merely a small depression or cicatrix, on the surface attached around or in part to the wall of the chest by adhesion. The track through the lung may be readily seen, in such cases, after death, with moderate care in the dissection of the part, although during life it interferes so little with the respiratory murmur as not to be observable, unless by its greater distinctness from the thinness of the intervening parts.

Case 88.—Mrs. Magnus was wounded by a small pistol-ball, which entered on the right side from behind, between the seventh and eighth ribs just under the arm when hanging down, and passed out in front over the cartilage of the sixth rib, more than an inch from the pit of the stomach. She had not spit blood, and the ear declared the lung to be pervious to air at the wounded part, which induced me to think that the ball might not have penetrated the cavity, although it might have injured the pleura. I abstained, therefore from feeling or enlarging the wound; lest I might make that penetrating which was actually not so. As she suffered great pain when I saw her, twenty-four hours after the injury, the breathing being oppressed, Mr. Adams bled her into a hand basin, until I found she was about to faint. She lost nearly thirty ounces of blood, but her symptoms were quite relieved, so as to render any other bleeding during her treatment unnecessary. At the end of the third day, she spat a very little blood after removal in a carriage to another lodging, and then gradually recovered. After four different stethoscopic investigations, I came to the conclusion that the ball had not struck the lung in the first instance, although it adhered to the pleura costalis, by which adhesion the patient was saved from much mischief, as the lung in all probability suffered from some abrasion or ulceration at that point, which gave rise to the expectorated blood.

The five first cases are instances of wounds of the upper part of the lung, which are in general more dangerous than those of the lower part, from the vessels being larger, and from the greater difficulty with which any extravasated blood or fluids can escape. They also prove that when blood is poured out in small quantity, it may be absorbed; what that quantity may be is doubtful, but auscultation will now render that more simple, which was formerly very doubtful.

These cases also shew that the inflammation of the substance of the lung is less in healthy persons than might be expected after so severe an injury.

In cases in which the external opening or wound does not communicate freely with the cavity of the chest, the principal danger arises from the inflammation of the pleura ending in effusion, which, if not evacuated, leads to the loss of the individual. It is the great fact to be attended to in the treatment of pistol-wounds of the chest, or those made by small balls which do not pass out. All the persons I have seen die from small balls, have died with the affected cavity more or less full of fluid. The *post-mortem* reports of all persons killed in England, in duels by wounds through the chest, unwittingly attest this fact, as well as the insufficiency of the surgical treatment they received; and the necessity for the future for its amendment. It is in these cases that the stethoscope is most valuable; its constant use is indispensable whenever the respiratory murmur has been gradually yielding before the encroachment of the effused fluid, which, in the first instance, looks nearly like red-coloured serum. When this murmur ceases to be heard, except at what is the upper part of the chest whatever the position of the patient may be, it is full time to enlarge the original opening, or to draw off the fluid by the trocar and canula.

Case 89.—Sir C. Bampfylde, the minutes of whose case I have lost, was wounded by a pistol-ball in the back, which passed into the chest through the lower part of the lung of the right side, and lodged on the inside of the wall of the chest in front, and to the right side, sticking in and against a rib; but giving rise to no external marks or signs of mischief at that part, unluckily for him, so as to admit of an operation for its removal. The inflammatory symptoms having been restrained, it was nevertheless, plain to me that the cavity of the chest was full of fluid, and that the oppression in breathing arose from it, and not from the injury done to the lung. The stethoscope was then unknown, the ear was not in use; my older colleagues were obstinate, they would not hear of an operation for enlarging the wound into the chest, and as our patient was, unfortunately for him, shot in London, instead of in the pass of Roncesvalles, or on the bridge over the Bidassoa at Irun, we let him die on the eighth or ninth day, without all the aid which surgery might have given him. It is possible he would not have recovered under any circumstances, from the ball being lodged, and his advanced age. Yet if the cavity of the chest had been emptied, the ball might have been discovered and removed.

Case 90.—A soldier of the fifth division of Infantry was wounded at Toulouse by a musket-ball, which entered between the fourth and fifth ribs of the right side, near the sternum, and came out behind, nearly opposite, fracturing the ribs, the splinters of which were removed. The first symptoms of inflammation having been in some degree subdued by the sixth day, were followed by those more immediately indicating effusion, such particularly as great oppression, difficulty of breathing, inability to lie in the recumbent position, which induced me to introduce into the posterior wound a gum elastic catheter, through which, after a little pressure, a quantity of red serous fluid was withdrawn, exceeding perhaps three pints in measure. On the removal of the catheter, the discharge of fluid ceased, and, under a strict antiphlogistic treatment, the man gradually recovered, so as to be sent to England on the following June.

If the matter had been purulent, I should have enlarged the wound; if the symptoms of oppression had returned, I should have repeated the operation perhaps lower down. Auscultation, if it had been then known, would have smoothed away many difficulties.

Case 91.—M. Scharf has related an interesting case in Casper's Wochenschrift, which has been translated in the 36th vol. of the *Medical Gazette*, for March, 1845, page 978. The patient was gored by a bull, on the 24th of May, 1842, on the right side of the chest, the third and fourth ribs of which were broken; called on the second day, M. Scharf found a wide gaping wound, about two inches broad, with a passage leading downwards and inwards, from which, at each act of respiration or coughing, either a bloody serous fluid or air was expelled with a hissing noise. The patient had lost a large quantity of blood, chiefly from the wound, some by coughing. A piece of the third rib had been forced into the chest, and part of the lung had protruded, but both were replaced. On the 27th, and following days, a most abundant discharge of a bloody serous fluid took place from the wound, which at each effort of coughing, spirted out in considerable streams, mixed with air bubbles. By degrees this matter became thicker, and more puriform, but at the same time very fœtid; occasionally more than a pint was discharged at once. Air ceased to escape from the wound about the second week. The cough and expectoration diminished in proportion as the lad's strength improved, and about the sixth week they ceased. The sounds on percussion, which, so long as the cavity of the pleura was filled with fluid, had remained dull, became clearer as the respiratory murmur extended over the hitherto compressed lung. At the present time, March, 1845, they are both perfectly natural. He breathes without the least difficulty, and both sides of the chest expand alike.

In this case, it should be observed that to the great bloody discharge which took place on the fourth day after the receipt of the wound, and to the free exit of this, and to the subsequent flow of matter the patient owed his safety.

This case is otherwise deserving of attention from the perfect restoration of the function of the lung, and the absence of all falling in of the walls of the chest.

Case 92.—A Soldier of the 40th Regiment was wounded at Toulouse on the 10th April, by a musket-ball, which entered about two inches below the nipple of the right breast, passed through the cavity and the lung, and came out behind at a nearly opposite point, injuring the ribs above and below, without entirely destroying their continuity. He was bled largely on the morning of the 11th, and again at night; on the 12th it was repeated; some small pieces of ribs were extracted from both orifices, and some part of his dress from the anterior one. He spat blood when he coughed, and respiration was difficult. Calomel, opium, and antimony, were given in pills every six hours, and the bleedings were repeated daily, and sometimes oftener for the first eight days, during which time, a free discharge, at first serous, afterwards purulent, took place from the wound, after which the inflammatory symptoms subsided; the cough became easier; the expectoration less, and free from blood; breathing easy. The calomel was omitted; a mild farinaceous diet was allowed instead of a little gruel, and a very little bread and milk; in a fortnight the wounds began to heal. On the 1st May, some small pieces of rib were removed from the anterior wound, after which both gradually closed, and he was forwarded to Bourdeaux on his way to England in the beginning of June, cured.

C. Boutflower, *Surgeon to the Forces.*

Case 93.—Corporal Dunlary, of the 69th Regiment, was wounded on the 16th of June, 1815, at Quatre Bras, by a musket-ball, which entered the thorax, fracturing the seventh rib on the forepart of the right side, and lodged. He lost a large quantity of blood from the mouth, he says, and some from the wound, between that and the 19th, when he was brought to the hospital in Brussels. The pulse was then quick and hard, respiration difficult and anxious, and a bloody discharge issued from the wound on every respiration; bowels confined since the accident; was bled to forty-four ounces; saline purgatives, with calomel, and antimony, and opium, were given until the 29th June, when the wound discharged good pus. From this time, at different periods for six weeks, he lost ninety-two ounces more blood, being strictly placed on milk diet, and several pieces of rib exfoliating. He was sent home on the 31st August, declaring himself quite well, as well as ever he had been in his life; the ball remaining undiscovered.

Case 94.—John Butler, 71st Regiment, was wounded on the 18th June, at Waterloo, by a musket ball, which fractured the underpart of the right clavicle, a little to the outside, injured the brachial plexus of nerves, without affecting the vessels, passed obliquely downwards, backwards, and inwards through the chest, injuring the superior part of the lung, and came out about an inch and a half from the base of the scapula, opposite the spine. He spat blood in moderate quantity, breathed with some difficulty, suffered from pain in the part, and from total loss of the use of the right arm. He was bled largely several times during the first fortnight; during which period some little blood and matter were discharged from both wounds. They gradually, however, closed, and on the 20th of August, 1815, he was sent to England, cured, with the exception of some slight difficulty of breathing on exertion, or walking quickly, and with paralysis of the right arm.

Case 95.—A soldier of the Fusilier brigade was struck by a musket-ball on the right side of the front of the chest, at the battle of Albuhera, which entered between the fifth and sixth ribs, passed through the lungs, and lodged. Three days afterwards, when the first symptoms were in part subdued, he complained of pain in a particular spot, nearly opposite to where the ball entered, and at which part something could be felt deeply seated. As an incision could do no harm, and the removal of the ball would do good, I made it, and found the ball lodged in the intercostal muscles and between the ribs, whence it was easily removed. A considerable discharge of reddish-coloured serum followed, with great mitigation of the symptoms, after which, under strict treatment, the man recovered, and was sent to Elvas with every prospect of a cure.

The following are examples of wounds of the chest, attended with formation of matter and ultimate recovery but with some alteration of the size and appearance of the chest.

Case 96.—Lieut.-Colonel Harcourt and Major Gillies, of the 40th Regt., were both shot through the chest, at the head of the regiment, at the successful assault of Badajoz; the wounds were as nearly similar as possible, from before directly backwards. They were taken to the same hut, and treated alike with the same care by Mr. Boutflower, the surgeon of the regiment, with whom I saw them daily. The inflammatory symptoms ran high in both. In Major Gillies, a tough old Scotchman, they could not be subdued, and he died at the end of a few days, of pleuro-pneumonia. Colonel Harcourt slowly recovered, and died Marquis d'Harcourt, near Windsor, more than twenty-five years afterwards, suffering little or no inconvenience from his chest, when I last saw him.

Case 97.—Lieut. Forder was wounded, on the 13th Sept., 1810, off the Mauritius, by a musket-ball, which entered two inches outside and a little above the nipple of the right breast, passed through the chest in a direction slanting downwards and backwards, and can now (Feb. 24, 1843) be felt under the integuments of the back. He lost a great quantity of blood from the wound, and was bled so frequently as to be unable, as he supposed, to move in his bed for six weeks, from it and from the quantity of blood and matter which was discharged by the wound. This continued for four weeks before it diminished, and eight before the wound closed. He coughed and expectorated blood before the wound healed, and frequently afterwards until the present time, when occasional recurrences take place. The affected side of the chest is flatter in every way than the other, and respiration is very indistinct, both above and below the injured part. In this case the lung has, I have no doubt, adhered to the pleura lining the ribs, after becoming indurated in parts and diminished in size, drawing in with it, as a means of cure, the wall of the chest.

Case 98.—Major M'Gibbon was struck by a musket-ball on the fore part of the right side of the chest, in Spain, which went directly through and came out behind. Some pieces of rib were removed from both orifices, together with a portion of his dress. He lost a quantity of blood by the mouth, and some by the wound, and fell as if dying. The anterior wound was so large as to admit the finger readily into the cavity of the chest, and remained open so as always to allow the evacuation of the fluids poured out into the cavity of the pleura. Slowly recovering from the shock caused by the injury, re-action followed by degrees, and then the difficulty of breathing became excessive. He was bled many times during the first week, in large quantities, as the inflammatory symptoms in the cer who first saw me, almost immediately after receiving the wound, some blood was intermixed with the saliva. I became extremely faint, and remained so about an hour and a half, after which I rode four or five miles, to the village of Waterloo, where I remained until about nine o'clock, without any other person seeing me. I was bled in the course of the night-time, by Mr. Ambrose, assistant-surgeon, Royal Artillery, which relieved me from the great difficulty I had in breathing; this difficulty was accompanied by a severe pain down my neck, chest, and right side; until the evening of the 19th I was much easier, but in the course of the night the difficulty of breathing becoming much greater, and the spasmodic affection having very much increased, I was bled seven times, until the middle of the next day. 20th. I continued better, but was then seized with the most violent spasms in my neck, chest, and stomach imaginable. I could scarcely breathe at all, and was in the greatest possible pain; I was again twice very largely bled, and my stomach and chest fomented for a length of time with warm water and flannels. I passed a very tolerable night, and continued pretty well until two o'clock the following day, when I was again very largely bled, by which I was very much relieved; I continued pretty well, and free from much pain; but my pulse having very much increased, and having a good deal of fever on the 23rd, Mr. Powell, who had attended me after the second day, again bled me; after this, I continued free from much pain, or difficulty of respiration, and on the 26th was moved into Bruxelles, when I came under your care. I forgot to mention that when I was so violently attacked, had two lavements most vigorously applied; salts, &c., proving of no avail, took digitalis, commencing ten drops every four hours, and increasing to fifteen from the second day."

N.B. Up to this period, the 2nd of July, the devil a bit have I eaten.

Whilst with fat mutton chops, and nice loins of veal,
You stuff your d—d guts, your hearts are all steel,
Oh! ye doctors and potecaries, you'll all go to hell,
For cheating our poor tripes of their daily meal.

H. Dumaresq.

To G. J. Guthrie, Esq.

The ball in this case was lodged in the rib, which ultimately became much thickened around it. He recovered with good health, but with occasional spasms in the chest; and died of apoplexy, in Australia, twenty-five years afterwards. His doggerel lines, which I cannot suppress, shew the buoyant and unconquerable spirit of a soldier, who knew that his chance of recovery was but small. It was a most gallant, a most friendly spirit.

G. J. G.

If the ball had caused a greater degree of irritation, I was prepared to cut down upon the rib, and remove a part of it if necessary; for I have seen balls so situated slip from their lodgments, causing general inflammation, suppuration of the cavity, and death, which must almost always ensue in such cases, unless the ball can be removed, and the matter evacuated by the operation for empyema.

The two following cases are more remarkable, as shewing the advantages derived from the removal or passing out of a shot, however large.

Case 108.—Mr. Collins, of Renton, has recorded in the eighth volume of the *Provincial Medical Journal*, the case of Capt. Wynn, of the 23rd Fusiliers, wounded in Holland on the 2nd October, 1799. He came under the care of Staff-Surgeon T. Hunter, on the 2nd of December, who found him expectorating large quantities of purulent matter, with a wound in the side through which no matter came until the 11th, when a probe passed into the chest for several inches, then struck against a ball. On the 12th Dr. Hunter enlarged the wound, sawed away a portion of one of the ribs which had been broken in the passage inwards of the ball, and removed an iron grapeshot weighing three ounces and a half and three grains. After this Capt. Wynn gradually recovered, and it is believed lived several years afterwards.

Case 109.—Captain, now General Macdonald, of the Royal Artillery, was present at Buenos Ayres, when a bombardier of that corps received a wound from a two-pound shot, which went completely through the right side, so that when led up to the General, who was lying on the ground, he saw the light quite through him, and supposed he was of course lost; this however did not follow, and some months afterwards the man walked into Capt. Macdonald's room so far recovered from the injury that he was able to undertake several parts of his duty before he was invalided.

## LECTURE XI.

*Appearances after Death, in Gun-shot Wounds of the Chest, when not followed by Empyema; Mr. Franklin's Case; Mr. Hesse's Cases; Mr. Bruce's Case; Case of Mr. Drummond; Dr. Moore's Case of Gun-shot Wound of the Lung, the Ball remaining in the Viscus during many Years; Dr. Houston's Case; Cases by Dr. Stokes, Mr. Keate, Sir E. Home, and Mr. Guthrie; Removal of Splinters of Bone, or other foreign Bodies, from the Wounded Lung; Probing with Sharp-pointed Instruments to be avoided; Expectoration of Buttons, Wadding, Pieces of Cloth, and Bone; M. Guerin's Case of Musket-shot Wound, in which a large Incision was made for the Extraction of foreign Bodies; Mr. Guthrie's Cases; Fatal Consequences of foreign Bodies lying loose in the Cavity of the Pleura; Diemerbroeck's Cases; Mr. Guthrie's Cases of Gunshot Wounds of the Chest, the Ball lying loose on the Diaphragm; Case of Major-General Sir Robert Crawford; Mr. Key's Case; Baron Larrey's Cases; Mr. Collier's Case.*

The following fatal cases show the appearances presented after death, when not accompanied during life by a formation of matter of any standing, terminating in empyema.

**Case** 108.—A French soldier, shot through the right side of the chest at the siege of Badajoz, had been brought down the Tagus from Abrantes, to the hospital at Lisbon, when under my direction, and died in the December of 1812, apparently of consecutive phthisis. The ball had gone through the chest from before, directly backwards; the posterior wound was closed; the anterior one was fistulous, and discharged a small quantity of matter, of which he spat up daily a large quantity until he died. The lung was diseased throughout, and contained several vomicæ or small abscesses, from which the matter expectorated was secreted. The track of the ball was nearly filled up, although the part immediately around was harder than usual. The lung adhered in many places to the wall of the chest, which was much flattened.

In other cases I have found portions of wadding, of leather belts, of splinters of different lengths, pieces of buttons, and even balls.

**Case** 109.—Private John Read, 61st Regiment, was wounded at Toulouse, on the 10th of April, by a musket-ball, which entered the chest immediately under the left clavicle, at its articulation with the sternum, and lodged. He went on remarkably well, without a single unpleasant symptom, to this morning, May 2nd, when he was seized with a rigor, succeeded by heat of skin, quick pulse, terminating in profuse perspiration. The evening found him tolerably well; perfectly cool; his bowels regular.

May 3rd. About the same hour as yesterday, was attacked with rigor, lasting for nearly half-an-hour, followed by heat and perspiration; complains of nothing particular in the wound, on careful examination of which, I found and removed some small pieces of bone; at six o'clock the same evening, he was attacked with violent pain in the breast, confined to no particular spot, and attended with extreme difficulty of breathing; took sixteen ounces of blood from the arm; covered the chest with a blister; and gave an antimonial diaphoretic.

4th. Pain of the breast moved to the back, nearly as far down as the lowermost rib, and extremely distressing; tongue white; skin hot; pulse 90, small. Rep. venesectio; took only ten ounces, as the blood yesterday evening shewed no appearance of a buffy coat. Calomel gr. ij, pulv. antimon. gr. ij., opii gr$\frac{1}{4}$, every second hour; dilute with cold tea and lemonade. He died early next morning.

On examination after death, I found the ball had fractured the second rib, and had lodged deeply in the substance of the lung, the soft and gangrenous state of which did not allow me to trace its course. The cavity of the pleura contained above a pint of fœtid purulent matter. An extensive abscess had also formed in the opposite lung.

H. **Franklin**, *Asst. Surgeon, 27th Regt. now Inspector-General in India.*

**Case** 110.—A French soldier was wounded by a musket-ball, at the battle of Waterloo, which penetrated the chest, fracturing the second rib, passing through the lung, and went out behind in nearly a straight line, close to the spine. Left on the field of battle for five days, before he was brought to Brussels, he was nearly dead with difficulty of breathing, and other symptoms of inflammation, from which he recovered in the course of the next ten days, under repeated bleedings and the strictest antiphlogistic regimen. At the end of this time, and when apparently doing well, an accession of inflammation and of all his bad symptoms took place, destroying him at the end of four weeks from the receipt of the injury. On dissection, the lung was found adherent to the chest by false membranes of some thickness, with a quantity of purulent fluid in the cavity. The track of the ball was in a suppurating state, and two pieces of rib were found in the centre of its course. The whole of the lung appeared to be filled with a sero-purulent fluid, which could be squeezed out from it.

Case 111.—A French soldier was wounded at Waterloo by a musket-ball, which broke the second rib of the left side, and came out close to the spine behind. He spat up a considerable quantity of blood, and remained four days on the field of battle. Relieved after his admission into hospital at Brussels by repeated bleedings, he appeared to be likely to have a fair chance for recovery, when, another serious attack of inflammation supervening, he died. Being present at the moment, I had the body opened, and found that the ball had gone through the upper part of the left lobe of the lung, which adhered both in front and behind to the wall of the chest; the track was well marked, and in a sloughy state, the rest of the lung being full of a purulent secretion, with some very tinted serous fluid in the cavity, which bore general marks of having suffered from inflammation.

Case 112.—Private John Roth, of the 5th battalion of 60th Regt., aged 29, had been wounded by two balls, one on the 10th April, 1814, at the battle of Toulouse, which grazed the left temporal bone; the other had gone through the upper part of the right chest, in the Pyrenees, the autumn before. Both had healed. He was seized on the 8th of May, after a little intemperance, with pains in his body and joints, pain in the chest, and cough, with bloody expectoration, skin hot, tongue foul, bowels confined. On the 9th he was bled, and purged by calomel, and antimony, and salts. On the 10th symptoms augmented, pulse 120, small, wandering, but no pain in the head. Repeat the medicines. Head shaved and cold applied; V. S. ad ℥x. 11th. Every symptom increased, great pain on touching the chest, pulse 126, skin hot. On the 12th, passed his urine and fœces involuntarily; and on the 13th he died, his body being covered by petechiæ.

The head, on examination, shewed pus under the dura mater, at and behind the situation of the wound he had received. The right lung adhered to the walls of the chest where the ball had entered and passed out; the track made by it being very visible, indurated, and inflamed, from the last attack: the parts otherwise sound; no fluid in the cavity.

J. G. Hesse, *Surgeon, 5th Bat. 60th Regt.*
Mont de Marsan, 14th May, 1814.
To G. J. Guthrie, Esq.

Case 113.—Antwerp, July 28, 1815.—Thomas Stilfox, of the 1st Life Guards, aged 40, received a punctured wound of the thorax on the 18th of June at Waterloo. The wound was inflicted by a lance, which penetrated the cavity of the thorax, between the second and third ribs, about four inches from the sternum, and wounded the right lung. He remained on the field of battle four days without assistance, during which period he had frequent attacks of hemorrhage. On his admission, considerable hemorrhage recurred. There was emphysema of the chest; difficulty of breathing; incessant cough, during the act of which the air rushed forcibly from the lung. He had also received a sabre wound, which extended from the temporal end of the zygomatic process, to below the left ala of the nose, penetrating through nearly the whole of the buccinator; the parotid duct was completely exposed but uninjured. He had several slighter wounds in different parts of the body, and a considerable one of the thigh; pulse quick, hard, and wiry; tongue white; bowels constipated, not having had an evacuation for some days.

Spoon diet; V. S. ad ℥xx. Infusion of senna, and sulphate of magnesia, and mistura oleosa et vin. antim. c. opio.

June 29. Had some sleep; emphysema over the chest considerable; pulse hard and full; some blood and air escape from the wound; difficulty of breathing continues; medicine operated freely; V. S. ad ℥xii. A roller applied round the chest; the wound covered with simple dressings, those of the thigh and face brought together with adhesive straps.

June 30th. This day the discharge from the thorax resembles blood mixed with water; air escapes from the wound, which is kept open, and in a depending position. Emphysema somewhat abated; skin warm; pulse 100, full, but easily compressed; bowels open. In the other wounds there is no disposition to unite. Mistura demulcens.

July 1. Passed a restless night; pulse increased in strength, with considerable febrile action; severe cough; complains of pain in the chest; emphysema as at last report. Twelve ounces of blood were taken from the arm, and the mixture was continued.

July 2nd. Cough and respiration somewhat relieved; discharge from the wound of a thin dark colour; pulse still full; bowels costive; no disposition in the other wounds to unite. Ol. ricini ℥j. Mistura oleosa c. opio.

July 3rd. Has been delirious through the night; no sleep, and is incoherent this morning; pulse 100, but weak; discharge from the wound excessively copious and fœtid; tongue dry; has had two small evacuations.

4th. A considerable sinus has formed in the thigh, under the rectus muscle, with a purulent discharge. In other respects as at last report. Infusion of cinchona with sulphuric acid, alternately with the demulcent mixture.

6th. Was attacked with severe cough and vomiting last evening; copious discharge from the wound of the thorax, and excessively fœtid; the emphysema has abated; countenance sunk; pulse hurried, and very feeble. The bark and the demulcent mixture were continued, with an increased quantity of opium.

7th. Cough and vomiting abated; when questioned, says he feels no pain; his respiration is quick and hurried, and he appears to be gradually sinking.

8th. Debility increases, with considerable emaciation and low delirium; sleeps little, and that disturbed. Medicines continued.

10th. Was attacked this morning with an obtuse pain of the side, opposite the site of the wound, extending to the mediastinum, accompanied with considerable difficulty of breathing; dry cough; heat of skin; anxiety, and thirst; pulse weak, soft, and irregular; bowels confined. A blister was applied as near the seat of pain as could be done; he took a mixture of squills and camphorated tincture of opium, and had a purging enema.

11th. Pain complained of yesterday is relieved; debility extreme: discharge from the wound intolerably offensive and acrid, excoriating the surrounding skin; cough dry, with little expectoration, and that pure pus; great thirst; restlessness; frequency and irregularity of pulse; air passes through the wound, causing a peculiar stridulous sound.

12th. Immense discharge of pus from the chest; the wound of the face is gangrenous; considerable difficulty of breathing, attended with wheezing and sense of suffocation; pulse weak and intermitting; tongue dry, and covered with a dark brown fur. The infusion of bark was continued, and demulcent mixture with opium.

14th. Died at seven o'clock this morning.

On dissection, the lung on the wounded side shewed evident signs of considerable inflammation having taken place; the pleura was covered by coagulable lymph; and the wall of the thorax exhibited the same appearance, with adhesions in several places; several abscesses were found in the substance of the lung, and the wound which had penetrated deeply into the upper lobe of the right lung was partly in a gangrenous state. His strength throughout was supported by light fluid diet, and latterly by some wine.

S. B. Bruce, *Surgeon to the Forces.*

Case 114.—Mr. Drummond was wounded by a pistol-ball, in the back, low down, about two inches from the spine, and three inches from the inferior angle of the scapula, which was afterwards found to have entered between the eleventh and twelfth ribs, and to have *passed between the base of the lung and the diaphragm,* abrading the former, and passing through the latter into the abdomen, ultimately lodging in the fat under the skin, over the cartilage of the eighth rib of the left side, nearly at an opposite point in front. From the absence of all symptoms of shock and alarm, it was hoped by some that the ball might have run round, but on the removal of the little ball its course could not be traced. This occurred on Friday. On Saturday morning at five o'clock he suffered great uneasiness, and difficulty of breathing, accompanied by a particular catch or jerk in respiration, indicating a wound of the diaphragm. The stethoscope and the ear attested the clearness of the respiratory murmur in every part of the chest, which sounded well, and I was satisfied the lung was not materially injured; twelve ounces of blood were drawn with difficulty from both arms. At ten o'clock, the jerk and difficulty of breathing being greater, the left temporal artery was opened, as no blood could be drawn from the veins; five ounces only could be obtained; a dose of calomel and a senna draught had been accompanied by the discharge of a teaspoonful or two of blood, leaving no doubt on my mind that the ball had penetrated the cavity of the abdomen, as well as of the chest, and that a bowel had been injured. With a constitution apparently unequal to bear an inflammation of the most dangerous character, or the remedies necessary to subdue it, the prospect was but melancholy; thirty-six leeches were applied around the wound in front, but they drew little blood. Pulse from 108 to 112. Dr. Hume, Mr. B. Cooper, and Mr. Jackson, were added in consultation until Monday at twelve, when the jerk became worse, the oppression in breathing greater. Mur. Morphiæ, gr. ss; at two bled to twelve ounces, blood very buffy; calomel gr. ii.; opii gr. ½; every two hours. In the evening, V. S. ad ℥xiv., as no more would flow. Tuesday morning, five o'clock, V. S. ad ℥xii., as he could bear no more. The ear now indicated for the first time effusion. It was not, however, in sufficient quantity to render its evacuation necessary. After this he gradually sunk, and died on Wednesday morning. He lost on the whole fifty-six ounces of blood. On examination after death, it was found that the ball, after entering the cavity of the chest, slightly abraded the left lung at its lower and inferior edge; which was covered by recent lymph, the lung being internally sound. The left side of the chest contained nearly a pint of red-coloured serum. The ball had perforated the diaphragm, or muscular partition dividing the chest from the abdomen, grazed the fat of the left kidney, passed through the great omentum below the stomach, to the part where it was extracted, injuring no very important organ in the abdomen in its transit, but giving rise to an effusion of blood from some small vessel which had sloughed, and which was found coagulated and diffused to the amount of twelve or more ounces; this I believe to have been the immediate cause of death.

Case 115. Jan. 16, 1846.—*Wound of Lung, from the Lancet: Dr. Moore, of Plymouth.*—Mr. Lennon was wounded by a musket-ball, in December, which entered about the right sixth rib, midway between the spine and the scapula. He fell, became faint, and experienced a sensation of suffocation accompanied by bloody expectoration. As blood issued in large quantities from the wound, some rags or cloth were stuffed into it, and bound on with a sash, which gave great relief. Carried to the Havannah, the wound healed slowly; in the March of the second year, 1798, being in Kingston, Jamaica, he dined in public, drank wine, and coughed up something which proved to be a part of his shirt and nankeen jacket, which he had worn in action fifteen months before. Each piece was about an inch and three-quarters round, with jagged edges. In London, suffering from uneasiness in the lower part of the chest, from the part where he supposed the ball was lodged, he was desirous of undergoing an operation for its removal, from which he was dissuaded by Sir A. Cooper, and he died of paralysis, in August, 1846. On examining the chest, the *left* lung was found adherent to a great part of the costal pleura, and the lung appeared to occupy an inclosed space, the mediastinum bulging into the right cavity of the chest. The *right* lung was contracted to one-third of its natural size, and adhered to the upper part of the chest; its consistence was flaccid, and entirely wanting the resilience and mottled appearance of a healthy lung: indeed, although portions of it floated in water, it may be questioned whether, during life, it was of much use. The track of the ball could not be perceived. The shot had entered between the fourth and fifth ribs, fracturing the former; was embedded in the substance of the lung, and firmly attached by a pedicle half-an-inch long, consisting of condensed lung and cellular membrane, to the inner surface of the third rib, just at the junction of the osseous and cartilaginous portions. The ball was shewn to be completely surrounded by the substance of the lung, being contained in a sac so closely in contact with it, that it was difficult to remove it when half exposed by incision. There was no serous effusion in this cavity of the chest, the lower two-thirds of which were occupied by the diaphragm, which rose as high as the sixth rib (in the inclined position of the body), and pressed upwards to such an extent, that on making an incision from above into the convex part of the diaphragm, the knife, instead of exposing the posterior edge of the liver, disclosed the large intestines. The sensation of the ball being situated low down in the chest could not be accounted for.

Case 116.—Dr. Houston, in the ninth vol. of the *American Journal of the Medical Sciences* for 1845, has related the case of a man who, when twenty years of age, lodged by accident the contents of his gun in his left side, consisting of a large ball, a thick linen patch, and some tow wadding, which entered between the fifth and sixth ribs, beneath the axilla. The ball passed in the direction of the ribs, and was extracted by the side of the spine with a small piece of bone; some wadding was removed from the orifice of entrance; blood was expectorated, and considerable hemorrhage took place from the wound. He partially recovered, so as to undertake the ordinary duties of his station, but suffered always from cough, the formation of abscesses in the axilla, and was best in health after such occurrences. Some seventeen years afterwards the cough and general derangement of health were accompanied by severe spitting of blood, which alone gave him any alarm, and from which he gradually recovered. Worn out by indigestion, cough, expectoration, and at last by cholera, he died twenty-five years after the receipt of the injury. On examination after death, the upper portion of the lower lobe of the left lung was found in a state of complete hepatisation, and attached to the wall of the chest for about two inches around the anterior opening made by the ball, by very strong adhesions, and behind in a similar manner, a piece of the sixth rib having been carried away by the ball in its exit. There was a cavity in the lung in the direction of the course the ball had taken, communicating with the anterior opening between the fifth and sixth ribs, which was circular, and capable of receiving the little finger. In this cavity the linen patch was found, coiled up in the shape of a silk-worm, and which, when soaked in warm water and spread out, was found to be two inches and a half long by two in width. The stethoscope disclosed nothing that might not have been expected from the general history of the case. The remaining portions of the lung were in a healthy state.

Case 117.—A soldier was wounded by a musket-ball, which, after breaking the head of the humerus, and rendering amputation at the joint necessary, penetrated the chest a little above, and to the outside of the nipple, and lodged. Dying at the end of twenty-five years, during which time he had suffered frequently from hemorrhage from the lungs, and from difficulty of breathing approaching to suffocation, the ball was found lodged, surrounded by the substance of the lung, and attached between the third and fourth intercostal spaces. The cavity in which it was found was irregular, and communicated with several dilated bronchial tubes....*Revue Medicale, tome* 4. *page* 301.

Case 118.—Dr. Stokes, in the third vol. of the *Dublin Journal of Medical Science*, relates the case of a man who was wounded by a musket-ball in the left interscapular region, which perforated the lung, and lodged anteriorly close to the insertion of the diaphragm. This patient suffered exquisite and increasing pain, from the time of his wound to the period of his death, little more than a fortnight afterwards. The slightest attempt at extension of the side brought on such suffering, that he constantly kept himself bent down to the left side, and when Dr. Stokes saw him, the side was two inches less than the opposite one, which, with the occurrence of bronchial respiration in the postero-inferior portion, caused great doubt in the minds of some of his attendants as to the existence of an empyema. The heart was displaced, and pulsated strongly at the right side of the sternum. The operation of puncturing the chest was performed, but the operator made the incision too low, misled by the great contraction of the side, and entered the abdomen. On dissection, the pleura was found to contain a vast quantity of matter, and was extensively covered by coagulated lymph. The ball had passed through the lung from above, downwards and forwards, and its track was greatly dilated by the effusion, and lined also by lymph.

Case 119, By Mr. Keate.—A gamekeeper's gun burst at the Red house, Battersea, and a small part of the lock entered the middle of the arm, and passed upwards into the axilla, whence it could not be traced by Mr. Keate, who saw him within an hour after the accident. The symptoms which followed were those of inflammation of the chest, which were subdued by active treatment; the wound healed, and he returned to his occupation in Wiltshire. Having exposed himself to the night-air, some time afterwards, the inflammation of the chest returned, and he died. On opening the thorax, one edge of the bit of iron was found impacted in the surface of the lung, the other edge was rubbing against the inside of the sixth rib, which was nearly worn through by the constant friction it underwent during respiration; there was also a mark on the pericardium as of a cicatrix, and of a graze on the surface of the heart.

Case 120.—Sir E. Home had an opportunity of examining the body of a gentleman, who died thirty-two years after being shot through both sides of the chest. The ball entered on the left side, between the third and fourth ribs. Great bleeding took place from the lungs, and he slowly recovered in the next three years.

On removing the sternum and exposing the lungs to view, their external surface was found healthy. The spot where the ball entered the lung on the left side was very readily discovered by the remains of a small cicatrix; the membrane at that point being thinner than common, and having a punctured appearance, which terminated in a central point. This part of the lung had not the slightest adhesion to the pleura, but was in its natural detached state. The course of the ball through the substance of the lung was traced by dissection, for an induration of the substance of the lung was formed wherever it had passed; as seen by making transverse sections of the thickened parts. The appearance of the lung in the right side was of the same kind, but less in degree. The course of the ball was through the upper lobe of the right lung, about two inches and a half from the upper part. The portion above this did not contain air; was more dense than natural, and sunk in water; but was not shrunk or contracted, and contained some serum.

Case 121.—Among the French prisoners in Lisbon in the spring of 1813, I saw a man in whose chest a ball had entered, midway between the fifth and sixth ribs, and lodged, and from which a constant and considerable discharge of purulent matter took place. As he appeared about to sink under his complaint, I desired to be informed when his death took place, that I might be present at the examination. It proved to be a case of a ball lying between the diaphragm and the spine, surrounded by coagulable lymph, and adhering by its envelope to the spine and diaphragm at the angle formed between them; there was a very thickened pleura costalis, the lung was shrunk and attached by membrane almost equally thickened across the chest, the lower part was filled in the upright position by the discharge, which was only evacuated in quantity when the opening of the wound was made dependent.

I saw a case after the battle of Waterloo, among the French wounded, somewhat similar. A portion of rib had been driven in, and the assistant-surgeon was aware that the ball could occasionally be felt. The man died at the end of a fortnight, the cavity containing a quantity of sero-purulent bloody matter. The lung had been injured by the ball, which had fallen loose into the cavity.

The removal of splinters of bone, or of other foreign bodies from the lung, has occupied the attention of surgeons from the earliest periods, and some of them proposed to draw a piece of cambric, and other things, through the chest, for the purpose of removing them. These extreme measures have been abandoned, but there can be no doubt of the propriety of removing as many of these causes of irritation as can be either seen or felt. I have already said, if the ball has broken a rib, the orifice of entrance especially should be enlarged as early and as carefully, as possible, so as to give an opportunity for the removal of the splinters, and of all angular points of bone which may be turned inwards. A little addition to the original opening, if such addition be necessary, can do no harm, and if the lung should be adherent, will enable the surgeon to see whether any splinters are impacted in it, and to remove them. It is possible that the end of the finger may be even introduced, and the lung felt, if it should not have receded too far; and as it is insensible to such an operation, no evil will ensue; but all probings with small, sharp-pointed instruments should be avoided. Of the effect of such large incisions as that stated in the following case, I have no knowledge. That wadding, buttons, pieces of cloth and of bone, have been frequently coughed up, I have had experience; and although it is said balls have even been brought up, I have not had an opportunity of seeing them, and place neither hope nor faith in their occurrence, although I disbelieve nothing. Dolœus asserts that a soldier coughed up a ball, by which he had been wounded many years before. Murat declares that he found a ball in the lungs of a man who lived twenty years after he was wounded, in good health. Percy says, his friend, Ch. Marquis de Bavilly, wounded ten years before, was then in good health, having spat up several pieces of wadding with which the gun was loaded. I have seen several persons expectorate pieces of cloth, and splinters of bone, after the lapse of a considerable time, and recover, but never a ball. These cases are exceptions to the general rule, that such wounds are usually fatal; but do not the less shew the necessity for every fair attempt being made to remove such foreign matters at the earliest period.

Case 122, by Guerin, *Mem. de l'Academie de Chirurgie*, tome 2, p. 215.—An officer was wounded by a musket ball, on the 9th of July, 1745, which passed through the chest, entering in front, and fracturing the seventh rib near its junction with the cartilage attaching it to the sternum, and passing out behind, near the angle of the same rib, which it again broke, together with the one immediately below it. The openings of entrance and of exit were each enlarged to the extent of nearly two inches, by dividing the pleura, the intercostal muscles, and the integuments, from within outwards. Several splinters of the rib which injured the lung were removed, of which the smallest might be half an inch or six lines long, by two wide. A tent was then passed through the wound. The patient suffered much, spit a great deal of blood, pulse feeble, extremities cold. He was bled three times the first night, and twenty-six times during the first fifteen days, the seton being retained in the chest the whole time. On the twenty-second day, a piece of cloth was felt by the finger, after removing the seton, and was extracted; a splinter was also felt, but so deeply that it could not be removed without enlarging the incision. As the inflammatory symptoms were re-excited, he was bled for the twenty-ninth time. On the thirtieth day, these symptoms had so much increased that the seton was withdrawn, under the impression that it was doing more harm than good, and the thirty-first bleeding was effected. The next morning the patient complained of something pricking him within, and the parts left between the two original wounds after the incisions which had already been made, were divided. The chest was now open from the articulation of the head of the rib with the sixth and seventh vertebræ behind, nearly to the cartilage in front; and we saw the whole course of the ball, which had made a groove in the surface of the lung, in the substance of which a splinter was sticking. This was extracted, and the wound dressed simply, after which the patient gradually improved, and was quite cured in four months.

The two first incisions for the removal of the splinters were necessary. The tent or seton drawn through the chest was a great error; and although the fortunate result of the case depended probably on the removal of the splinters of bone sticking in the lung, I fear few would survive the operation performed for their removal.

When the lung can be seen through the opening made by the ball, or after some moderate enlargement for the purpose of removing any splintered pieces of rib or any spiculæ which can be perceived, the object is attained. I have not had experience of the utility of large incisions for the purpose of making the lung more visible, although the importance of extracting foreign substances at first is admitted, provided their situation can be distinctly ascertained.

Case 123.—A Spanish soldier wounded at the battle of Toulouse, was brought to me the same evening, shot through the right side of the chest, between the fifth and sixth ribs, one of which was fractured, the ball passing out nearly opposite behind. On removing the splinters by the aid of an incision, I found that the lung was adherent to the inside of the chest, and I was enabled to withdraw from within the lung some splinters of bone, and a part of his coat. He left Toulouse apparently doing well, but as I have frequently stated, natives of warm climates rarely suffer from such severe attacks of inflammation, as those of northern habits and constitutions.

The adherence of the lung to the pleura lining the walls of the chest, was doubtless the principal cause of his safety.

Case 124.—A soldier of the German legion was wounded at the battle of Waterloo, the 18th June, 1815, by a musket-ball, which entered between the seventh and eighth ribs in front, about two inches from the sternum on the right side, passing out behind. He died in York Hospital, Chelsea, in the month of January following, where he was brought after some drunken fits at the Savoy barracks, which induced an attack of pneumonia. A fistulous opening existed, and had discharged a little matter which was gradually diminishing; the sinus was from six to seven inches long, extending into and nearly through the base of the lung, and was lined by a mucous membrane, the lung around being thickened to the extent of from a quarter to half an inch. There was but little fluid in the cavity, although the lungs on both sides shewed signs of recent inflammation, without which he would in all probability have recovered. The orifices of entrance and of exit through the lung adhered to walls of the chest, and thus separated the track of the ball from the general cavity of the pleura, and would have led in all probability to his ultimate recovery, if it had not been for his intemperance.

When splinters of bone, or other foreign substances, sticking into the lungs, are thrown off early, they are apt to fall down upon the diaphragm, and become fatal sources of irritation, of which I have seen several instances.

When a ball, or portion of bone, leather, cloth, wadding, or other foreign substances, are driven into the cavity of the pleura, they usually give rise to fatal results, constituting therefore cases of the greatest importance, to which attention has not been sufficiently given, but on which too much cannot be bestowed, if life is to be preserved by the art of surgery. The neglect of these cases has probably arisen from the insufficiency of the means of ascertaining them, an insufficiency which auscultation has in some measure removed, and which the science of surgery may further elucidate. The presence of a ball, a piece of bone, or other substance, lying upon or rolling about on the pleura, covering the diaphragm, must, it will be conceived, give rise to more or less irritation, inflammation, and consequent suppuration, or the formation of matter upon the surface of that membrane in its thickened state, until, in all probability, the foreign substance is removed, or the persons waste away and die. Baron Percy, in his *Manuel de Chirurgien d'Armée*, page 125, alludes to several cases in which balls have been known to roll about in the chest, and the patients have recovered. This observation has been copied by several of those who have followed him, but disbelieving the accuracy of the statement, I referred to such of the authorities alluded to as I could procure, and do not find that they authorise it. Diemerbroeck, who has been quoted for one case, says, in his eighty-eighth observation :—

Case 125.—A young woman was wounded on the 20th May, 1637, by a musket-ball reflected from the slating of a roof, which entered the chest between the fifth and sixth ribs, about three fingers' breadth from the spine, and going slantingly through the external part of the lung, struck against and broke the under part of the fourth rib, without however passing through it, but remaining in the cavity of the chest; little blood flowed from the wound, but a good deal was coughed up on the second day. She did not complain of pain except in the wound behind, and where the rib was broken in front; this in a short time subsided, and the broken rib united. On the 30th May, she became exceedingly ill, and was supposed to be dying, but was relieved in the evening, on spitting up a great quantity of pus mixed with a little blood. The wound discharged but little, and nothing from the cavity of the chest. On the 7th of June a little more pus was coughed up, and in ten months she was cured. At the end of a year, she only felt, on any great exertion which increased her breathing, a sense of weight referred to the diaphragm. The ball in this case is not said to have rolled about, and in probability was lodged where it struck.

In his annotations on this case, he mentions that of a man stabbed by a knife quite through the right side of the chest, who, after two years of great suffering, recovered, the greater part of the lung being so destroyed by suppuration, that when he threw himself violently backwards and then forwards, it was heard to strike against the sides of the chest, like the clapper of a bell. At the end of ten years he saw him quite well. There can now be little doubt that the noise arose from fluid in the chest, and that the lung was in all probability bound down to the spine by adhesion, as is known to occur in such cases.

He also relates another nearly similar case, in which the wound was kept open by the fingers whilst lying on the face, until all the effused blood was discharged from the chest. It was then closed. and the patient recovered, so as to be free from inconvenience from it afterwards; and he refers to *Hildanus*, *Fontanus*, *Pareus*, *Jessenius*, *&c.*, in proof of such recoveries, even when portions of the lung had been cut away, which cases I cannot find.

Case 126.—A dragoon of the King's German Legion, was wounded between the eighth and ninth ribs, at the battle of Salamanca; the ball had entered and lodged; the symptoms were severe; the breathing very laborious, and as the discharge from the wound was not free, I enlarged the wound, removed some scales of bone, a bit of cloth, which stuck between the ribs, the lower of which was broken, and evacuated a great quantity of bloody colored fluid, not purulent. After a few days the discharge became purulent, and as he felt something, as he thought roll within him, which he supposed might be the ball, I contemplated again enlarging the wound, so as to be able to see whether anything was loose in the cavity. A sudden relapse of inflammation, from drinking imprudently a little *agua diente*, or brandy, carried him off. On examination, the ball was lying loose on the diaphragm in the chest, and might with some enlargement of the wound, have been extracted.

Case 127.—A French prisoner of war, who had been wounded on the frontier of Spain, by a musket ball, which lodged in the left side of the chest, had been sent to Lisbon, in 1812, with a considerable discharge through the wound, of which he died; some few days after I took charge of the station, this case was mentioned to me as a curious one; the ball being found in the angle formed between the diaphragm and the spine, enveloped in coagulable lymph, by which it was attached to the spine; there were some splinters of bone enclosed with it, an occurrence which took place generally, from which the sufferer was for a length of time confined in the recumbent position to his bed.

Case 128.—A soldier of the 29th Regt. was wounded at Talavera by a musket-ball, which penetrated the right side of the chest, between the fourth and fifth ribs, and lodged. He died on the day afterwards, and, on opening the body, I found that the ball had passed through the lung, and was lying loose on the ribs behind, near the union of the diaphragm with the spine.

Case 129.—Major-General Sir Robert Crawford was wounded at the foot of the lesser breach at the storming of Ciudad Rodrigo, by a musket-ball, which passed through the posterior fold of the arm-pit, and entered the side of the chest in the axilla by a small opening or slit apparently too small to allow a ball to pass through. I saw him with Dr. Robb, a few minutes afterwards, when, from the general anxiety manifested, I was satisfied of the severity of the injury. The symptoms were not at first urgent; but their continuance and augmentation in spite of the most rigorous antiphlogistic treatment led, in a few days, to his death. On examination of the body, the ball was found rolling about on the diaphragm; the cavity of the chest contained a large quantity of very turbid serum; false membranes had formed on the lungs, which were compressed towards the spine, and at the upper part retained the mark of an injury as from a ball which had not force enough to penetrate and lodge.

Case 130.—A law writer was admitted into Guy's Hospital, under Mr. Key, on the 7th May, 1845; he had shot himself with a pistol, making a wound, in length about two inches and a half, to the left of the sternum over the sixth rib. On the 8th, two small bullets were removed from over the angles of the tenth and eleventh ribs behind. Some pieces of bone being removed from the wound in front, air gushed out, indicating, possibly, an injury of the lung. Respiration in the upper part of the lung, feeble but distinct; no hæmoptysis; no pain, except on motion, when it becomes acute; pulse 94. 9th. Pain in the left side; expectorates very little blood, and some yellowish muco-purulent sputa; respiratory murmur still audible in the upper surface of the lung; great debility. 10th. No spitting of blood; pain the same; vomits frequently, and of a dark coffee ground appearance; the oozing from the wound has been rather copious, and now has an offensive smell, consisting chiefly of blood and serum. 11th. A more copious discharge of bloody serum, and continued. Some wadding and other extraneous matter were removed from the anterior wound. On the 12th, he died. On examination, the parts about the anterior wound were found sloughy and gangrenous; the sixth rib comminuted. The fifth and seventh were also fractured. A spiculum of bone was projected into the lung, which presented a half-collapsed appearance. An old firm band of adhesion behind the left nipple. The effused blood into the left pleura was scanty, and of a thick bloody or purulent nature. The balls in this case appear to have struck the patient in the act of expiration, when the diaphragm had ascended, pushing the lung upwards. The balls, therefore, penetrated it in front, after going through the anterior and lower part of the lung, and thence into the abdomen, causing a deep and rugged furrow across the upper surface of the spleen; they then re-entered the chest, making another and more ragged perforation of the diaphragm, went through the posterior base of the lung, about an inch from the angle of the rib (the eleventh) behind. There was no blood or fluid in the abdomen.

Two different students who were present at the opening of the body, inform me that the third ball was lying loose near the spine.

In this case, Dr. Addison pronounced the lung to be carrying on its respiratory functions in the usual manner in the first instance. If the patient had lived longer, it was supposed, he might have suffered from hæmorrhage from the spleen into the abdomen, unless it adhered to the diaphragm, when the fluid might have been poured into the chest.

Under all these circumstances the practice to be pursued, if the patient had lived some eight or ten days instead of six, would have been to have enlarged the opening behind, and have carried it into the thorax, so as to have evacuated the fluid which could not have found its way out by the anterior opening.—G.

Baron Larrey has had the good fortune to meet with some remarkable cases of this kind. In the first he did not see the man for some weeks after the wound had been inflicted, the ball entering the upper edge of the fourth rib, about an inch from its junction with the cartilage. By means of a bent and flexible sound introduced through the wound, he distinguished a hard, metallic substance at the bottom of the cavity of the chest, which he supposed to be the ball, and nearly in the situation of the place where the operation for empyema is usually performed. This operation being done, about twelve ounces of pus escaped, and the ball was discovered rather flattened. It was easily removed by a pair of polypus forceps. After this there was every prospect of recovery, until the patient, unfortunately, having one day drank too much brandy, was attacked by enteritis, and died.

Case 131.—Louis Claye, twenty-six years old, was wounded at the battle of Mobilowe, in Russia, the 22nd of July, 1812, by a musket-ball, which penetrated between the eighth and ninth ribs of the right side. He fell insensible, and remained two days on the field of battle, likely every moment to be suffocated. He lost a considerable quantity of blood by the wound, and by the mouth especially, for five days. Effusion took place into the chest about this time, and one of the surgeons in attendance enlarged the wound, and let out several pieces of cloth, and a pint of bloody serous fluid, mixed with clots of blood. After this the patient gradually improved, and was sent to the hospital of Thorn, in the rear, where, after some weeks, the wound closed for a short time; an abscess afterwards formed at the edge of the false ribs, and broke, discharging a great quantity of purulent matter, and several more pieces of cloth, after which it healed. The original wound now ulcerated, and discharged also a considerable quantity of dark coloured purulent matter, which continued to drain away during four years, until he arrived in Paris, the 15th of June, 1816. Baron Larrey, after examining the cavity of the chest with an elastic sound, discovered the ball at the bottom on the right side. The fistulous opening was small, the discharge great, fever hectic; he, therefore, enlarged the wound, and caught the ball with a pair of forceps; the space between the ribs was not, however, sufficiently great to allow of its being drawn through, the ribs having approximated to each other, in consequence of the gradual flattening of the chest. Under these circumstances the Baron decided on cutting out a portion of the superior edge of the lower rib, which he effected by the lenticular or buttoned knife, used for the removal of points of bone after the operation of the trephine. After enlarging the wound horizontally and perpendicularly, he removed two-thirds of the rib, by successive layers, before the semi-circular opening was large enough to allow the ball to be drawn out with great difficulty. Some serious symptoms which followed the operation gradually subsided; when, on a sudden bending of the body, the patient fractured the portion of the rib which had been left undivided, and tore the intercostal artery, from which he lost so much blood as to place his life in danger. The bleeding was arrested by the compress of Desault; and the patient escaped from the difficult situation in which he had been placed, after thirty days of great anxiety and constant care. He returned home on the 1st of October, 1816, and recovered his health; the side of the chest being, however, flat, respiration extinct, &c.

CASE 132.—A soldier of the ex-guard was brought to the hospital of Gros Caillou, in August, 1814, in consequence of having been wounded at the taking of Paris by the allied forces, and in some degree neglected. The ball had penetrated the chest, carrying away the upper part of the fourth rib, from which wound he lost much blood at the time, and expectorated a considerable quantity. It had now become fistulous, and matter was freely discharged from it when the opening was made dependent. He was very thin, and suffered from hectic fever. On examining the cavity of the chest with an elastic sound, it struck below upon a hard metallic substance, which I supposed to be the ball, and which, by external measurement with the same sound, appeared to be nearly in the situation in which the operation for empyema is performed, which operation having been done, three palettes (twelve ounces) of pus were evacuated, and the ball discovered, and extracted by a pair of polypus forceps. Some inflammation followed, but was dissipated in two days, and the superior or original opening shortly healed. The patient's strength was supported, and he gradually improved, so as to offer hope of a complete recovery; when he was seized with enteritis, after drinking brandy, and died, six months after the receipt of the wound, and a hundred days after the removal of the ball. On opening the body, the seat of the discharge, from the small opening which remained, was found close to the opening made by the knife; the two ribs nearly touched at this part; the pleura costalis was enormously thickened, the mediastinum was depressed towards the injured side, and a gangrenous mass, supposed to be the obliterated lung, filled the upper part of the cavity, which was greatly diminished in size.

CASE 133.—William Barrett, of the Life Guards a middle-aged muscular man, of full habit, was wounded by a musket ball, at the battle of Waterloo, which fractured the third and fourth ribs behind the left side, and broke the left arm. He was brought to Brussels, where the inflammatory symptoms were subdued by repeated general and local bleeding, and the other ordinary but strict antiphlogistic means, during the first six weeks, by which time the external wound had nearly closed, and no trace could be perceived of the ball. At the end of this time, staff-surgeon Collier, now Inspector-general of Hospitals, under whose care he was, and who furnished me with these particulars of the case, which I saw in Brussels, and in which I was interested, found that his symptoms became worse, that he had rigors and evening exacerbations; and that the difficulty of breathing had increased almost to suffocation; he decided on opening into the cavity of the chest, by following if possible the course of the ball. This he did by a deep incision, which enabled him to remove with difficulty some pieces of the ribs which were denuded but not detached. A bag-like protrusion was then felt between the ribs near their angles, which was opened, and nearly two pints of thick fœtid pus escaped; the relief which followed being as complete as sudden. The wound was dressed from the bottom, and every means adopted to prevent its closing, except introducing a tent, but in vain; the opening closed, and matter again collected, requiring a second incision for its removal. Between these two operations, small bleedings were resorted to most beneficially. A short gum elastic catheter was introduced into the cavity of the chest after the second incision; but little matter, however, was secreted, perhaps from the very guarded treatment pursued, and his reduced state of health. From this he gradually recovered, and was sent to England, cured, in November—being, as Mr. Collier remarks, one of the most gratifying cases he had ever treated.

## LECTURE XII.

*Consequences of Traumatic Inflammation of the Chest; Effusion; Condition of the Lungs and Pleura; Mode of Cure, when an Operation is performed early; Use of Auscultation in such Cases, or when a Ball is rolling about on the Diaphragm; Cases by Gérard and Dupuytren; M. Baudens on the Encysting of Balls, or Splinters of Bone, within the Chest; M. Baudens on the withdrawal of Fluids from the Chest by a Syringe; Cases by M. Baudens; Necessary to have a Dependent Opening; Danger of Puncturing the Abdomen; Experiments at the College of Surgeons and Charing Cross Hospital; Results of these Experiments; Anatomy of the Parts concerned in the Operation; Mode of Operating.*— Wounds of the Diaphragm: *Cases by Paré, Sennertus, Hollerius, Guillemeau, Chevreau, and Mr. Guthrie; Baron Percy's Cases of Rupture of the Diaphragm; Baron Percy on the Diagnostic Signs of Rupture of the Diaphragm; Case of Capt. Prevost; Cases by Mr. Guthrie; M. Baudens' Case; Case of Serjeant Barry; Dupuytren's Case; Mr. Robinson's Case; Case after the Battle of Sobraon; Baron Larrey's Case; M. Baudens' Cases; Symptoms of Wound of the Diaphragm.*

I have noticed in Lecture IV., on empyema, the symptoms accompanying the formation of matter in the pleura; in Lectures V. and VI., I have enumerated the morbid appearances which are discoverable after death, and the operations to be performed in ordinary cases for the relief of the sufferers. The last Lecture contains several very important cases, highly interesting on all points, whether ending in death or recovery. In Case 129, that of General Sir Robert Crawford, the ball had just impulse enough to penetrate the wall of the chest, and fall down on the diaphragm, causing death by the inflammation which ensued, followed by effusion. Case 131 shews a ball rolling about on the diaphragm, removed by cutting out a portion of the rib, and Case 21 is an excellent example of a small ball, descending by ulceration, through the lung, by its own weight, until it fell on the diaphragm. Cases 118, 119, 121, 125, 126, 127, 128, 130, are instances of balls, either falling or being about to fall into the cavity of the chest, or being gradually dislodged from the bodies of the vertebræ, or the inside of the ribs, by the suppurative process, which after having loosened, at last permitted them under some sudden or peculiar movement, to slip out and fall on the diaphragm into the angle formed by it and the last ribs and spinal column; where they have been sometimes found, surrounded by purulent matter, or enveloped by coagulated lymph, or false membranes, the result of long-continued disease.

It has been shewn in several places, that the first important effect of inflammation in these cases, is effusion, followed by the formation of matter, which compresses the lung against the spine, and back of the chest or other part to which it may be attached, until it becomes nearly impermeable; whilst the lymph, or fibrin deposited on and around its pleural covering, bind it down, and affix it so firmly to the adjacent parts, as to prevent its expansion to any extent, even if the pressure of the surrounding matter should be entirely removed. The pleura lining the chest, becomes thickened, sometimes to more than an inch in extent, and nature makes some efforts, which are usually unavailing, to relieve herself by an external opening. The thickened pleura becomes honeycombed by ulceration, which extends deeply to the ribs, portions of which as well as of the vertebræ may become carious, separate, and fall into the chest; and at last, if the patient should live so long, an external swelling indicates the approach of the matter to the surface, which may in this way be discharged for the moment, the opening remaining as a drain for the matter, which ultimately exhausts, and destroys the patient.

If a cure should be effected in such a case at an earlier period, by a favourable opening being made into the cavity of the chest, and the gradual draining off of the matter secreted, the lung can rarely again expand, although perfectly permeable to air, if bound down by its lately formed investing pseudo-membranes; and a cure can only be effected by the elevation of the diaphragm, which may ascend as high as the fifth rib, by the bulging of the mediastinum into the affected cavity, by its drawing along with it the heart, and by a change in the form and character of the ribs, by the flattening of one and the protrusion of the other, occasioning a certain degree of deformity of the side, by which the almost utter obliteration of the affected cavity is accomplished; the lung of the opposite side supporting life by its augmented and puerile respiration. Under such circumstances it must be obvious, that these evils can only be prevented by an early operation, capable of giving a ready exit to the matter secreted, and to any foreign substances which may have fallen into the cavity of the chest.

The use of the ear or of the stethoscope, which was unknown until after the termination of the

Peninsular war, has materially simplified the manner of obtaining information in injuries of the chest; and I have little doubt that the presence of a ball, rolling about on the diaphragm, can be ascertained by its means at an early period, so as to admit of an operation being undertaken with confidence for its removal; whilst the knowledge acquired by auscultation and percussion, of the filling of the chest by fluid, whether serous, bloody, or purulent, is incontestibly demonstrated by them. The presence of a ball, or of any other foreign body, decides the question, I apprehend, as to the place where the opening into the chest should be made; and, on this point, the information derived from the practice of the French surgeons in Algeria is important.

Case 134.—A captain of grenadiers, forty years of age, was wounded at the Siege of Barcelona, by five balls in the chest, three on the left, and two on the right side. He was blooded twelve times during the first four days. On the eleventh day, the sloughs having separated, he spat blood in quantities, and was bled again seven times in three days. On the thirteenth day, the spitting of blood had ceased. On the eighteenth a slough was removed from one of the wounds, and the finger introduced into the cavity of the pleura. During the next ten days, similar sloughs were withdrawn daily from both sides of the chest. When the sloughs ceased to be separated, the discharge became simply purulent, the upper wounds healed, and one fistulous opening remained on *each side*. On the fifty second day, the patient complained of pain in the right side, about the second and third false ribs, which part was swollen, and ultimately formed an abscess, which was opened, and a pint of blackish fetid matter discharged. Gerard, therefore, introduced his finger into the opening, felt he believed the peritoneum, and the diaphragm, in which there appeared to be an opening. On withdrawing his finger, he discovered the ball situated between the peritoneum and the transversalis muscle, and extracted it; he then passed a sound through the opening in the diaphragm into the chest. The cure was completed in seventy-one days.—Gerard in Percy, page 231.

Case 135, by MM. Marx and Paillard from Dupuytren.—Capt. Hesse, late of the 18th Hussars, who had been under the care of Mr. Guthrie, after the battle of Waterloo, for a wound of the right elbow, which arm he could not use, was struck in a duel by a pistol ball, which entered the left side, and lodged. He fell, and suffered great pain in the breast, the clavicle, and back of that side, but did not spit blood. These symptoms were relieved by the loss of from eight to ten pounds of blood during the first four days, when his friends thought him better, but he himself said he felt the ball move in his chest. On the fourth day he awoke from a distressing dream, shivering, and in great pain, suffered from paralysis of the left side of the face, and died in four hours, in inexpressible anguish. The ball was found on dissection, to have grooved the inside of the upper part of the sternum, breaking the head of the right clavicle, and splitting the bone in its length. Some portions of his clothes had been carried thus far by the ball, which then injured the inferior part of the brachial plexus of nerves. The ball was then reflected, and fell into the chest, where it was found lying in about ten or twelve ounces of blood, partly fluid, partly coagulated.

Auscultation does not seem to have been had recourse to, and no effective means were taken for the relief of the patient, save bleeding.

The practice of surgery on this point did not improve from Gerard and Percy to Dupuytren.

M. Baudens, whose labours I refer to with great approbation, says, in his *Clinique des Plaies d'Armes a Feu*, Paris, 1836, that he has seen splinters of bone and even a ball, surrounded by a cyst formed by the pseudo-membranes of inflammation, cut off from the general cavity, and confined in the angular space, formed behind between the rib, the diaphragm, and the spine. He mentions three cases of this kind, which must nevertheless be very rare, and is desirous of considering the observation of a ball, or of splinters of bone, encysted in this manner, as his own—as well as the proposal to remove them, or any other foreign body, by an operation in the interspace between the eleventh and twelfth ribs near the spine.

He re-introduced the method of drawing up matter from within the chest, by a sucking syringe or pump, not used occasionally, as recommended by Sabatier and others even before him, but retained permanently on the part. This proceeding may have been of some use in certain cases, nevertheless, I do not place any reliance upon it; unless accompanied by a dependent opening, through which the retained matters may readily escape, when most likely the sucking pump will not be of any great utility.

Case 136.—In a wound of the chest, between the second and third ribs, M. Baudens introduced a *sonde à dard*, such as is used in the high operation for the stone, and made it project behind between the eleventh and twelfth ribs. He cut down upon this, and extracted a ball and some splinters of the rib. The wound thus made was then closed, the upper wound was sucked dry daily by a pump, and the patient recovered in forty days.

A very brilliant result of modern surgery, but which would not have taken place, if there had not been a dependent opening for the complete discharge of the matter secreted.

Case 137.—An artilleryman, twenty-two years of age, was wounded on the 12th October, 1833, at Bougie, in Algeria, by a ball, which entered the right side of the chest, about an inch from the sternum, fracturing the third rib, and passed out behind, three fingers distant from the spinous process of the sixth dorsal vertebra. He was sent to Algiers fourteen days afterwards, suffering from acute pleuro-pneumonia, the entrance of the ball giving exit to an abundant and fetid suppuration. On the 1st Nov., the wound in the back was healed; that in front gave vent to large quantities of matter, and the finger, on being introduced into it, discovered two loose splinters of bone, which were removed. In order to abstract from the chest theretained matter, M. Baudens had recourse to a small pump, which he affixed to the wound by the aid of a large gum-elastic canula, which not only sucked up all the matter, but actually caused the ribs to be drawn inwards. This was used for five days, and some pieces of cloth were drawn out with the matter, and even a fly, which had got inside by accident. The wound was then closed, but matter re-formed in two days, and two quarts of offensive pus were withdrawn by the pump, used as before. Eight days afterwards the patient died. The third rib was broken in front, the sixth behind; some splinters pointing inwards, and retaining between them a piece of leathern belt. The lung, traversed in its middle part, shewed the track of the ball lined by a smooth black membrane containing pus. The pleura was in places half an inch thick, spotted with gangrenous points, and containing a large quantity of very offensive matter.

If, instead of pumping out the chest, the posterior wound had been re-opened, the sufferer might, I apprehend, have had a better chance.—G.

Case 138.—A., 54th regiment, was brought to the hospital at Algiers, on the 22nd of October, 1833, wounded eleven days before by a ball, which having broken the right clavicle was lost in the chest, without any sign of effusion having taken place, and he appeared to be going on well, until suddenly he complained of pain about the middle of the sixth rib, which could not be removed by the means employed, and was accompanied by a great discharge from the wound. On the 10th of Nov., he died. The clavicle and first rib were fractured, and an abscess had formed behind this part the size of a hen's egg, containing several splinters which had stuck in, and afterwards been separated from the lung. The ball had passed from above downwards and outwards, forming a sinus, which terminated at the middle of the sixth rib, to which this part of the lung was attached; the posterior three-fourths of this canal were closed, the anterior fourth contained two splinters of bone; one of which was about to fall into the abscess in front. The sixth rib was broken, although it had not been perceived during life, and a small digital cavity was formed at this part in it by the ball, surrounded by portions of lymph, floating loosely from its edges; from this the ball had been detached, and had given rise to the inflammation which destroyed him. The ball had fallen on the diaphragm, where it was lying loose, surrounded by a quantity of purulent matter.

M. Baudens says himself, and rightly, that the operation of opening into the chest should have been performed in the eleventh intercostal space, and that the wound in front should have been enlarged.

Case 139.—M. Baudens relates another case, in his eleventh observation, in which the posterior wound, situated near the angle of the tenth rib, had healed; the anterior one, half an inch below the clavicle, giving issue to an abundant and weakening suppuration. The lung above this was permeable to air, but the respiratory murmur could not be heard below it. To draw off this offensive fluid, he adapted an empty caoutchouc bag to a gum elastic canula, which he affixed against the orifice of the wound, and then sucked out six pints in five days. Some days later the wound behind re-opened, and a piece of bone was discharged from it.

It is possible that this re-opening, which was as good as an operation for empyema, aided materially in the recovery of the patient. Two years afterwards, the man was seen in good health.

The desire to have as dependent an opening in the chest as possible, has been manifested by all surgeons of experience in these injuries, and the interspaces between the ninth and tenth, and between the tenth and eleventh ribs, have been often selected for this purpose; but as the operation was done at, or as nearly as possible in the middle third of the chest, with the trocar, the abdomen was as often opened as the thorax, and death was frequently caused by the operation, even if it would not have been occasioned by the disease. To prevent, or to avoid this evil, M. Baudens advises its being performed at three fingers' distance from the spine, by incision, and he says he has frequently done it with success, although he does not give any circumstantial directions as to the operative method to be pursued, to which I therefore turned my attention; and caused several experiments and dissections to be made in the work-room of the College of Surgeons, in which Mr. Stanley, Mr. Arnott, and Mr. Quekett took great interest, and also at the Charing Cross Hospital, by Mr. Hancock, and by Mr. Canton with a similar result; viz.:—

1. That a trocar and canula pushed in between the eleventh and twelfth ribs, in a diagonal direction upwards, and on a line with the angle of the ribs generally, will in the *dead body* invariably enter the cavity of the chest without injuring the diaphragm.
2. That the same operation performed on the *living body*, would in all probability, if done at the moment of expiration, first enter the thorax, then pierce the diaphragm, and thus open into the cavity of the abdomen,—a difference in result to be explained by reference to the anatomy and physiology of the parts concerned; and shewing that the operation when required on man, should alway be done by incision, and not by puncture with the trocar and canula.

On examining the lower part of the chest from within, after removing the pleura, the diaphragm is seen forming the boundary between the thorax and the abdomen, commencing from the transverse process of the first lumbar vertebra, and forming an arch under which the upper part of the psoas muscle passes (the ligamentum arcuatum proprium). From this part extends another aponeurotic arch along the lower border, and to the end of the last rib, called the *false ligamentum arcuatum* (ligament cintré du diaphragme of Cruveilhier), which is nothing more than the upper edge of the anterior layer of the aponeurosis of the transversalis muscle, folded upon itself in all its extent. The diaphragm is afterwards attached to the lower border of the twelfth, and in succession to the eleventh, tenth, ninth, eighth, seventh, and sometimes to the sixth ribs, counting from below upwards. The external intercostal muscles are distinctly seen between the ribs, extending from the spine until they meet and are concealed by the fibres of the internal intercostal muscles, near the angles of the ribs. The vessels and nerves, after passing on the external intercostal muscles, subsequently run between the two.

The lower intercostal arteries arise from the aorta on each side, and before they enter the space between the ribs, give off a branch passing backwards to the vertebral canal, and the posterior muscles of the spine. The eleventh and twelfth intercostal arteries, covered at first by the pillar of the diaphragm, ascend on leaving the vertebræ to reach the under edges of the ribs, and are accompanied by a vein and nerve. The tenth intercostal artery, and those immediately above it, run almost horizontally, and nearly in the mid spaces of the ribs, as far as their angles, at which part a small artery is commonly given off, which descends from the main trunk at an acute angle to the rib below, and may be injured in opening into the chest, and be perhaps mistaken in operating, for the intercostal artery itself. From the angles each artery runs in a groove in the under edge of the rib as far as the anterior third, when they all become very much diminished in size, and leaving the grooves, run in the middle of the intercostal spaces until lost in their different anastomoses with the branches of the epigastric, phrenic, lumbar, and circumflex iliac arteries.

In making an opening into the chest between the tenth and eleventh, or between the eleventh and twelfth ribs, the artery will not be injured, provided the opening be made below the middle of the intercostal space, which is wider between the eleventh and twelfth ribs than between those above it. The vein is situated above the artery, and proceeds to the vena azygos major on the right, and to the smaller azygos vein on the left side.

The intercostal nerves are the anterior branches of the dorsal nerves, and lie below the arteries under the pleura upon the external intercostal muscle, until they approach the angles of the ribs, where they enter between the layers of the intercostal muscles.

It is worthy of observation that the pleura is necessarily continued over the inside of the twelfth rib, to line the different attachments of the diaphragm, and that an incision may always be made into the chest above this point, if done carefully.

On removing the integuments of the back, covering the muscles and the lower ribs, the broad expanse of the *latissimus dorsi* is brought into view, extending from the ilium and spine upwards and outwards, and covering all the parts of importance beneath, in the operation to be described. On the removal of the lower part of this muscle, the *serratus posticus inferior* is seen, of a somewhat quadrilateral form, arising by a thin aponeurosis, common to it and to the latissimus dorsi, from the spinous processes of the three superior lumbar vertebræ and two inferior dorsal, and proceeding upwards and outwards to be inserted, by four flat tendinous digitations, into the four lower ribs,

If this muscle be separated from its origins and turned outwards, or divided in the middle, and its two portions reflected, the posterior spinal or long muscles, running in and filling up the groove or hollow of the side of the spine, will now be distinctly seen, constituting what the French call the *fillet*, and composed chiefly of the sacro-lumbalis, and the longissimus dorsi muscles—sometimes considered as a whole, under the name of *erector spinæ*, or the *sacro spinal* muscle. This, which forms a thick mass over the beginning of the tenth, eleventh, and twelfth ribs, is not to be divided or interfered with, beyond a very few, at most, of its external fibres; the opening into the chest about to be made should begin at its external edge, and go through the external intercostal muscle, which is now exposed on a plane below it.

The eleventh and twelfth ribs, unlike all those which precede them, except the first, have only one surface of articulation with the corresponding vertebra, to which they are attached, instead of two facettes articulating, one with the body of the vertebra above, the other with that below. They form, and particularly the twelfth, a more acute angle with the spine than the others, which gives to them their greater degree of obliquity; whilst the freedom of their cartilaginous extremities enables the twelfth, particularly, to be depressed or separated by a moderate force from the rib above, to a greater extent than at any other part, by which means a foreign body of larger size may be removed from between them more readily than elsewhere.

*Operation:* — The eleventh and twelfth ribs having been distinctly traced, and the obliquity of their descent from the spine having been clearly made out, the patient being, if possible, placed on a stool, with the upper part of the chest supported by a pillow on a table before him; an incision should be made, over the intercostal space between these ribs, three inches long, and slightly curved, through the integuments down to the latissimus dorsi muscle; and as the mass of long spinal muscles is usually three inches in width, and can in general be seen, the incision should commence two inches from between the spinous processes of the eleventh and twelfth vertebræ, and be continued obliquely or diagonally downwards in the course of the interspace between these ribs. The latissimus dorsi and the serratus posticus inferior muscles being divided first at the upper part where they cover the longissimus dorsi, or the long spinal muscular mass alluded to, its edge becomes apparent, and from this point the latissimus and the serratus are to be further divided downwards. The external intercostal muscle being thus exposed, its fibres should be scratched through or separated, in the middle of the interspace between the ribs, which can now be seen as well as felt; so as to admit of a director being introduced below the muscle, on which it may be carefully cut through, as well as any fibres of the internal intercostal muscle, which may extend as far as the wound thus made. The pleura will be then exposed, and if the cavity of the chest contain fluid in any quantity, it can scarcely fail to project in such a manner as to convey to the finger the assurance of its being beneath. An opening may now be carefully made into it, at the upper part of the incision close to the external vertical fibres of the spinal mass of muscles, *at the moment of inspiration*, and on the existence of fluid being ascertained by its discharge, the opening should be enlarged, a director having been previously introduced under the pleura, as far as may be thought necessary for the admission of the finger, or any instrument which may be required.

The patient is desired to draw a full breath at the moment of puncturing the pleura, in order that the diaphragm may descend as low as possible, for if there should not be any fluid in the chest, the diaphragm in ascending during expiration, might be applied to the inside of the pleura lining the chest as high even as the fifth rib, counting from above, and might easily be divided with the pleura, if great care were not taken at this part of the operation; or if a trocar and canula were incautiously thrust in at such a moment. Whenever the smallest instrument of this kind is used, even in an explorative operation, it should only be introduced during the process of inspiration.

The preparations alluded to, as illustrative of these several points, are to be seen in the Museum of the College of Surgeons; one shows the rather rare anomaly of only eleven ribs; there is another of equal rarity in the College Museum, showing thirteen. In another experiment in which a ball and about a pint of fluid were introduced into the chest, between the first and second ribs, it was subsequently found that a lengthened adhesion existed between the lung and the fifth rib, on which as on a diaphragm, the ball and fluid rested, a fact which in the living body would have been distinctly pointed out by auscultation and percussion. In such a case the operation for the removal of the ball must be done above the rib to which the pleura may be attached.

*Wounds of the Diaphragm.*—Paré relates, in the thirty-second chapter of his tenth book, two cases of wounds of the diaphragm which were not immediately mortal. The first is that of a mason, who lived three days after being wounded through its tendinous part; the stomach had passed through an opening in it not larger than the thumb. In the second, the Capitaine d'Alon, in the suite of M. de Biron, was wounded by the ball of an arquebuss, near the ensiform cartilage, which passed through the *fleshy* part of the diaphragm, and went out between the fifth and sixth ribs of the left side. The external wounds healed, but a weakness of stomach attended by colicky pains remained, which carried him off at the end of eight months. A great part of the colon was found in the chest; it had passed through an opening not larger than the end of the little finger.

Sennertus in the twelth chapter of his second book, part second, p. 372, says, a student who had stabbed himself with his sword in the left side, was cured in two months, but died seven months after the injury, when it was found that the lung had been injured, and that the stomach had passed through a hole in the diaphragm; the heart being pushed over perhaps by it to the right side, of which change of position he was aware during life. Hollerius, sect. 6, p. 344, of his *Commentar. in Aphorism*, says, that he found a *cicatrix* in the diaphragm of a man, who had been wounded in the chest, and whose body he examined after he had been executed at Paris.

Guillemeau relates the case of a soldier, whose lung and diaphragm had been wounded by a ball, but who recovered, suffering, however, from indigestion, and more or less permanent colic; he died nine months afterwards. The colon was strangulated in the chest through a hole in the diaphragm, scarcely large enough to admit the end of the little finger. Chevreau gives an instance of a soldier, who died in 1818, having been wounded by a lance in 1815, which had left an opening in the diaphragm of half an inch in diameter, through which fifteen inches of the colon had passed into the chest.—*Recueil de Chirurgie Militaire.*

CASE 140.—A soldier of the 29th regiment, was wounded at the battle of Talavera, and died in four days after the receipt of the ball, which went through the chest into the liver. I found on examining the body, an opening in the central part of the diaphragm, of an oval shape, the edges smoothing off as if they were inclined to become round; this opening was nearly two inches long, evidently ready to allow either the stomach or intestines to pass through it on any exertion.

Baron Percy has recorded four cases of rupture of the diaphragm from accidents, with the passage of the stomach, or of the intestine, into the chest.

In the first case, the muscular fibres were ruptured on the left side for the space of five inches, in a woman who suffered a sudden fright during delivery. She died immediately; two-thirds of the stomach, and a part of the omentum and colon, were in the chest. In the second case, the conductor of a diligence from Paris to Calais, fell on the fore-wheel, and thence on to the pavement, and died. The diaphragm was torn from the xiphoid cartilage to the tendinous centre in the shape of a cross; nearly the whole of the floating viscera of the abdomen were in the chest, and six pounds of blood took their place in the belly. In the third case, a Parisian soldier, precipitated from the rock of Fort Belêtre, in 1793, fell on his feet, both of which were dislocated. The diaphragm was lacerated in every direction (*en tous sens*), and the mediastinum was torn from the sternum." In the fourth case, from Desault, a carpenter, 39 years old, was killed by a second severe fall from a height, and on opening the body, two lacerations were found in the diaphragm, one old, the other recent. By the old one the stomach and the arch of the colon had entered the left side of the chest, pressing upon and diminishing the lung to a small size. The opening was two inches and a half long; the omentum adhered on one side, and the spleen on the other; the recent opening was three inches long, through which another portion of the colon had passed into the chest.

The Baron thinks the risus sardonicus, or convulsive laugh, and the falling in of the abdomen, are principal signs of this accident, and regrets that these pathognomonic signs have not been noticed more particularly.

Case 141.—Capt. Prevost, aide-de-camp to Sir E. Pakenham, was wounded by a musket-ball, on the evening of the 27th Sept., 1811, in the affair which took place on the heights of Saca Parte, on the retreat from Fuente Guinaldo; it penetrated the chest from behind, splintering the ninth and tenth ribs of the left side, and made its exit a little below and to the right of the xiphoid cartilage. A good deal of blood was lost from the posterior wound, but he did not spit any up. As the army continued its retreat, he was carried to Alfaiates, and there he threw up a small quantity of bloody matter by vomiting. Thence he was removed to Sabugal, by ten in the morning of the 28th, until which time the posterior wound, which I had enlarged, had continued to discharge some blood, the intercostal artery being in all probability wounded. As he was much flushed in the face, and the breathing was becoming difficult, sixteen ounces of blood were taken from the arm, giving great relief, and the bowels were opened by the sulphate of magnesia.

On the 29th, V. S. ad. ℥xviii.

On the 30th, the pulse rose, and became quicker and fuller; the face red; breathing short and painful; V. S. ad. ℥xxxii., from which great relief was obtained; he fainted, however, on making a trifling exertion to relieve his bowels.

Oct. 1: Accession of symptoms as yesterday, and relieved by bleeding in a similar manner; bowels open.

2nd: Is better; free from pain; breathes easily; pulse good and compressible; the posterior wound discharges freely; has taken nothing but tea, and feels weak.

3rd: The inflammatory symptoms recurred this morning, and were again removed by the abstraction of sixteen ounces of blood; beef tea.

4th: Pulse compressible, soft, 96; respiration easy; was allowed some toasted bread with his beef tea. In the evening had a fit of coughing; and a little after, on moving, suffered from great pain in the posterior wound, which lasted until night, when forty drops of tincture of opium were administered, but without effect.

5th: A sleepless night had done him much mischief; he was evidently suffering from considerable internal mischief; wandered occasionally; pulse quick, 120, and small; felt very weak and desponding. A little light red wine given, with beef tea and a little bread; the opium continued night and morning.

6th and 7th: Much the same; and as the inflammatory symptoms were quiescent, attention was paid, by good nourishing soups, jellies, wine, &c., to his support; no cough; little or no pain; but the pulse always quick, with much general irritability.

11th: The integuments over the sacrum became sore, and gave much trouble.

13th: Appeared to have lost much of the use of his lower limbs.

15th: The wounds discharged considerably, particularly the posterior one; has a little cough; pulse continues very quick; spasms of the diaphragm troubled him for the first time, and gave great pain and uneasiness; they were relieved by opium in considerable and repeated doses.

16th: The cough became troublesome, with a good deal of expectoration, purulent and mucous, which increased during the 17th.

On the 18th, the spasmodic affection of the diaphragm, and the pain returned with great violence, and much reduced him.

On the 19th, they became so distressing as to threaten his dissolution, which took place on the 20th.

On examination, I found that the ball had passed through the under part of the inferior lobe of the left lung, and through the pericardium, under the heart, through the tendinous part of the diaphragm, and into the liver, before it made its exit. The wound in the lung was suppurating; the matter and fluid from the cavity of the chest had a free discharge by the shot-hole; the edges of the wound in the diaphragm were smooth, as if cicatrized, leaving between them an elliptical opening about an inch long. The injury to the liver was through the substance of the anterior part of its right lobe; the matter having a free discharge, and generally slightly yellow, as if tinged with bile in small quantity. The skin did not obtain a yellowish tinge, neither was the conjunctiva discoloured. It was hoped that the ball in this case had run round inside the ribs. The continued anxiety satisfied me to the contrary, even if the subsequent examination of the wound had not proved its fearful nature.

Case 142.—A soldier of the 23rd Regiment was wounded at the same affair, by a musket-ball, on the right side, which fractured the sixth rib, from three to four inches from the sternum, and passed out behind, between the ninth and tenth ribs, near the spine. The rib being fractured, the splinters were removed after an enlargement of the wound by incision, when the opening into the cavity of the chest was manifest, air being discharged freely from it. The shock in the first instance was great; but after a time reaction took place, and he lost a considerable quantity of blood in six bleedings during the first sixty hours. The discharge, at first serous and bloody, gradually became purulent, and the occurrence of jaundice shewed that the diaphragm and liver had in all probability been injured. Under the administration of calomel, antimony, and opium, this symptom was gradually disappearing, when I left him to rejoin the army; and he was sent to the rear at the end of ten weeks, nearly well.

Case 143.—A French soldier was admitted into the Gend'armerie Hospital, at Brussels, in consequence of a wound from a musket-ball, at the battle of Waterloo, which entered behind between the eighth and ninth ribs, near the spine, and lodged internally. After many severe symptoms, and much suffering, he died on the 1st of December, worn out by the discharge, which often amounted to a pint a day, and for the free exit of which the external wound had been early enlarged. On examination, the lung was slightly ulcerated on its surface, opposite to where the ball had entered, and a little matter contained in a sac formed between it and the wall of the chest. That the ball had gone on was proved by the fact of there being an opening in the tendinous part of the diaphragm, through which a portion of the stomach had passed into the chest, and from which it was easily withdrawn. The ball could not be found in the abdomen; in all probability it had passed into the intestine, and had been discharged per anum, as has happened in other instances.

Case 144.—A soldier of the 20th Regiment of the line was wounded by a musket-ball, on the 1st July, 1831, in Algeria; it entered about three inches from the sternum, on the right side, fractured the sixth rib, and came out behind, near the ninth dorsal vertebra. M. Baudens having enlarged the anterior wound, and removed two long splinters of bone, introduced his finger into the chest, and felt at the same time an opening in the diaphragm, a wound of the liver, and of the under part of the base of the lung. The patient was bled five times in the first forty-eight hours, and was cupped. Jaundice supervened, but he recovered in about two months. The discharge from the anterior wound was of a saffron colour; there was pain in the right shoulder for some time, and the arm was as if half-paralysed for several months.

These last symptoms must have been caused by some injury done to the phrenic nerve or its branches, and it is probable that in this case the liver adhered to the diaphragm, and ultimately closed the opening, a fact which I have known occur in two cases. The wound in the diaphragm had not united, but adhered to the surface of the liver, the peritoneal investment of which replaced the pleural covering of the diaphragm.

Case 145.—On the day preceding the battle of Fuentes d'Onor (in 1811), Serjeant Barry, being out skirmishing, one of the enemy, posted on the top of a steep hill, fired as he (the serjeant) was in the act of ascending the same, and wounded him in the chest. The ball entered close to the nipple of the left breast, and passed out at the back, between the eighth and ninth ribs. The anterior opening of the wound soon healed, but the posterior one did not do so for a considerable period. When the latter closed, he became affected by such severe cough, with expectoration, that his medical attendant deemed it proper to lay the same open again. Being kept so, the symptoms were relieved, and portions of his shirt and jacket were discharged. After this his health improved so rapidly, as to enable him soon to join his corps.

It appears, however, that the wound of his back repeatedly opened and healed—generally at intervals of twelve or fourteen months; but for the last five or six years it ceased to do so. It is stated that his appetite was very small and delicate; flatulence, &c., also much complained of; and if the stomach at any time happened to be overloaded, vomiting occurred. Bowels generally regular. The chief bad effects which this person himself attributed to his wounds were—that since receiving it, he had never been able to wear his knapsack with ease; and that his breathing became much affected whenever he walked at a quick pace, or ascended a hill.

He died of mortification of the left leg, Jan. 4th, 1833.

On examination, the whole of the stomach, and the greater part of the transverse arch of the colon, were found in the left cavity of the chest, having passed through an opening in the diaphragm extending about three inches in a transverse direction, near the centre of the dorsal attachments of that muscle. The peritoneum lining the diaphragm was firmly attached to the parts passing through it.

The wound in this instance was through *muscular*, not tendinous parts. The preparation is in the museum at Chatham, No. 63, Class 6.

Case 146.—From Dupuytren, P. R, Duboy stabbed himself on the 11th Feb. 1807, below the fifth and sixth ribs, near the heart; he was taken to the Hotel Dieu, and died almost suddenly suffocated, on the second of March. The diaphragm pierced on the left side, through its MUSCULAR part, showed no signs of inflammation, nor in its peritoneal coat; the opening was smooth, two inches from the ribs, and about one third of an inch long; a large portion of omentum had passed through it into the chest, from the left side of which about eight ounces of bloody fluid escaped,the intercostal artery having been wounded, whence the blood probably came.

CASE 147.—James Wilkie, 12th Light Dragoons, ætat thirty-four, was detached from the head quarters, with a squadron under the medical superintendence of Assistant-Surgeon Egan, who states that the deceased was suddenly attacked, at 4 p.m. of the 6th September, 1815, with violent pain in the umbilical and epigastric regions, accompanied with nausea and great irritability of stomach; his pulse small, rapid, and regular. He had a natural motion in the morning, and had eaten a hearty dinner of soup at twelve o'clock the same day with his comrades. Mr. Egan visited him half an hour after the attack, bled him freely, and caused the abdomen to be fomented with hot water; a large blister was applied to the seat of pain, an ounce of castor oil was given, and emollient and laxative clysters were occasionally administered. The castor oil was retained on his stomach, but the injections came away; at night the symptoms abated, and he slept about three hours. The next morning I was sent for from head quarters, and saw him about 10 a.m. His countenance exhibited that appearance of haggardness and anxiety which I have always found to be alarming indications. His pulse was feeble and rapid; the pain continued severe; at noon he vomited from two to three ounces of black fetid blood in a fluid state; his pulse became very feeble; at 4 p.m. the pains increased, and he ejected from his stomach from four to six ounces of dark fluid blood that had less fetor. His countenance sunk; his pulse fluttered, and became too rapid to be counted; and at six in the same evening he expired in pain.

This man, on the 18th of June, at Waterloo, received a punctured wound from a sword, which entered about an inch below the inferior angle of the scapula of the left side, penetrated the thorax, appeared to have passed through the diaphragm, and the point of the weapon came out on the opposite side of the chest, between the first and second false ribs. His wounds were quite healed, and he apparently enjoyed good health, when he arrived from the General Hospital, Brussels, in August.

*Appearances on Dissection.*—On opening the abdomen, the whole of the intestines, with the exception of the duodenum, were in a high state of inflammation. The colon particularly was of a dark chocolate colour, some spots inclining to sphacelus. On tracing the duodenum upwards, we were very much surprised at finding only a very small portion of the stomach in its natural situation. On opening the thorax, we discovered a large spherical tumour in its left cavity, which was accidentally punctured in dividing the cartilages of the ribs to elevate the sternum, which tumour or sac contained two quarts or upwards of black fluid fetid blood. On tracing it further, this sac appeared to be by much the larger portion of the stomach, which had protruded through the aperture in the diaphragm, by which it was so firmly embraced as to render the communication between that portion of the stomach in the thorax and that in the abdomen impervious to each other. The hernial sac and its contents were supported by the diaphragm, its upper portion being in contact with the pleura. The left lung exhibited a shrivelled, contracted appearance, as if its function had been impeded by the pressure of the sac and its containing fluid. The cicatrix and course of the sword were well marked. The cardiac and pyloric orifices of the stomach were in the natural cavity. The preparation was lost from having been immersed in spirit of bad quality.

Neufchatel, 28th January, 1816.

SIR,—I have to acknowledge the receipt of your letter of the 16th inst., and shall always feel a pleasure, if, by any slender means in my power, I can contribute to the extension of science.

It appears to me, in the case your letter alludes to, that the communication between the thorax and abdomen through the wounded part of the diaphragm, had become nearly if not quite impervious; that the edges of the wound adhered to the incarcerated portion of the stomach; but there was no adhesion of the stomach to the pleura in the thorax, or to the peritoneum in the abdomen, except at its incarceration. There was no alteration in the peritoneum, except the usual appearances after death, in enteritis, which certainly was the immediate cause of the fatal termination of the case, and not the displacement of parts; the opening in the diaphragm did not appear to be more than two inches, perhaps the width of the sword-blade inflicting the wound; the lips of the wounded diaphragm strangulating the stomach, were attached to it by adhesion; the strangulation of the stomach certainly arose solely from the diaphragm; the vomiting of a portion of black fluid blood in the latter stage of the disease, similar to that contained in the upper portion of the stomach, shewed that the communication between the portion of that viscus in the thorax, and that in the abdomen was not completely obliterated; perhaps the act of vomiting caused the diaphragm to expand so as to admit a portion of the fluid contained in the upper stomach to pass through the stricture, which ordinarily was of sufficient force to prevent its passing through by gravitation.

I have always found it extremely difficult to reason upon this extraordinary case, and can only do so from supposition; I conceive that the stomach may have been wounded by the same puncture which perforated the diaphragm, and that a portion of it passed through the perforation, that the wounded lips of that viscus coming in apposition with the wound in the diaphragm, union took place; that blood continued to flow from the wound in the diaphragm into the upper portion of the stomach, and as it became strangulated and distended with blood, it drew the inferior portion after it, till the hemorrhage ceased, and adhesion became complete; but this I am free to confess is mere conjectural reasoning, and I am not borne out in it by demonstrative facts. That the functions of life should have been carried on by so small a portion of the stomach, as remained in the abdomen, and that the patient should have lived in apparent health, supporting so great a weight of fluid on the upper surface of the diaphragm, is a very extraordinary phenomenon, and I think the history of the symptoms, while under treatment, must form an interesting case.

Henry Robinson, *Surg.*, 12*th Lt. Drag.*

G. J. Guthrie, Esq.

Case 148.—In the Appendix to my Lectures on the Injuries of the Abdomen, Case 114, is an instance of a wound received at Sobraon, on the 16th Feb., 1846, the man dying at Chatham, a year afterwards. The greater part of the stomach, the transverse arch of the colon, and the omentum had passed through a rounded opening in the diaphragm, two inches and a half in diameter, the peritoneum being continuous over the edges with the pleura.

Case 149, from Baron Larrey, *Clin. Chir.*, vol. 5 page 118.—J. B. Jerome was wounded, in Syria by a lance, which penetrated the right side of the chest, between the cartilages of the sixth and seventh ribs, and slightly injured the sternum. He fell from his horse, and fainted from loss of blood. The wound was closed, and he was sent to the rear. It afterwards appeared, that he had lost his voice, the loss continuing for several months; that he breathed with difficulty; that his countenance was spasmodically affected (*risus sardonicus*). He gradually recovered in part; thirty-six years afterwards, tbe Baron found that he could not speak without greatly elevating the larynx, accompanied by convulsive movements of the muscles of the eyelids, mouth, and face. The right lung appeared to be hepatised, giving out no sound on percussion. The least pressure on the right side of the chest, which was abnormally enlarged, gave great pain. The Baron supposed that the internal mammary artery was wounded in the first instance, and the phrenic nerve as well as the lung, and latterly that the par vagum had also been injured on the œsophagus. The cicatrix is six centimetres long.

Case 150.—N. J. Michaud was wounded by a sword, which penetrated deeply into the right side of the chest, between the sixth and seventh ribs, the latter of which was two-thirds cut through. The inferior edge of the lung was supposed to be wounded, as well as the central tendon of the diaphragm, the pain extending from the wound to the xiphoid cartilage. The muscles of the face were spasmodically affected; he could scarcely speak; the breathing was laborious; pulse small, quick, and nervous. The edges of the wound having been brought in contact, the surrounding parts were frequently cupped, particularly over the seat of pain, and blood was drawn from the arm twice in the first twenty-four hours; anti-spasmodic, emollient drinks were administered. The second day, the symptoms were all augmented in intensity. A sound introduced into the cavity showed that an extravasation of blood had not taken place; the anti-spasmodics were therefore increased, and the cuppings were repeated, under which the symptoms gradually subsided. The convulsive action of the muscles, constituting the sardonic smile, ceased, the breathing and swallowing became easy, the patient could lie horizontally, and he gradually recovered.

Case 151, by M. Baudens.—A fusilier of the Zoaves was wounded by a ball, which entered a little to the right of the xiphoid cartilage, and passed out at three inches' distance from the spinous process of the tenth vertebra. The conjoined cartilage of the false ribs having been depressed, without loss of substance, by the ball, it was drawn out at once by the finger, in doing which I felt the liver projecting through the diaphragm; some ounces of black blood were evacuated. An incision was then made behind, two inches in length, for the removal of some splinters of rib, and the escape of air, mixedwith blood, proved that the base of the lung had been wounded. This was followed by cough, expectoration of blood, hiccough, cold sweats, rigors, small pulse. At the end of several hours re-action took place, accompanied by great oppression, and pain extending from the region of the liver and diaphragm over the chest. The patient was blooded four times in three days, and the inflammatory symptoms were subdued; jaundice took place; the posterior wound discharged good pus, the anterior, yellow-coloured, for three months. By degrees, the want of sound (*matité*) at the base of the chest, caused by the effusion and affection of the lung, began to be dissipated, and the respiratory murmur returned. The patient recovered.

The decision manifested in this case by enlarging the posterior wound, in all probability saved the patient.

Case 152.—Ben Ali was wounded by three balls, on the 14th May, 1834, which entered the abdomen by the same opening in the epigastrium, and came out by two openings behind, one between the eleventh and twelfth ribs, the other lower down in the loins. He remained ten days without surgical assistance, at the end of which time he was received into hospital at Algiers. He stated that during the first four days he passed bloody urine, and vomited blood. His state on admission was as follows:—A hernia of the omentum, the size of half the hand, partly gangrenous, coming through the anterior wound, and adhering by its pedicle or neck to the surrounding parts. The third ball was lying an inch within the upper wound behind; bowels act every two or three days, with bloody striæ in the motions; urine bloody; skin hot; pulse frequent, hard, and small; tongue red; thirst; headache; pains in the loins and thigh, and left side; testes retracted. The omentum was cut off close to the integuments. Three arteries bled to the amount of sixteen ounces, which bleeding was arrested by a circular ligature around the pedicle of omentum, thus effectually strangulating it. Sixty leeches were applied next day to the left knee and thigh. Eight days afterwards, three round worms, from six to eight inches long, came out through the lower wound in the loins; forty-five days after the injury, he had no remains of inconvenience, beyond a difficulty in bending his back. The colon, stomach, left kidney, and the diaphragm, were all supposed to have been injured by this wound, and few acquainted with these injuries will doubt, that if he had been a native of Great Britain, or of a more northern climate, he would not have survived.

Cases 52 and 114, may now be referred to as those of injury, not only of the heart but of the diaphragm; and the whole collectively confirm the fact I was the first to point out, that wounds of the diaphragm, whether in the muscular or the tendinous part, never unite, but remain with their edges separated, ready for the transmission between them of any of the loose viscera of the abdomen which may receive an impulse in that direction. That parts of these viscera do pass upwards and back again, cannot be doubted; and it is probable that incarceration may take place for a length of time, before strangulation occurs from some sudden and distending impulse giving rise to it.

When the solid viscera of the abdomen are injured as well as the diaphragm against which they are applied in their natural situation, the wound may be considered a fortunate one; if the patient should survive, the liver or spleen may adhere to the opening in the diaphragm, and fill up the space between its edges.

A wound of the diaphragm may be suspected from the course of the ball, particularly when it passes across the chest below the true ribs. It is necessarily accompanied by an opening into the cavity of the abdomen, and is by so much the more dangerous. The symptoms will partake of an injury to both, although they are principally referrible to that of the chest, and are those of intense inflammation, accompanied by a difficulty of breathing which in case 114, that of Mr. Drummond, was a peculiar sort of jerk: in case 141, that of Capt. Prevost, it was more spasmodic. The risus sardonicus, hiccough, pain on the top of the shoulder, and loss of power of the arm, in all probability depend on some larger fibrils of the phrenic nerve being wounded. The treatment can only be antiphlogistic, and internal, beyond a free external opening for the discharge of matter. The accession of jaundice shews an injury to the liver; vomiting of blood, or its passage per anum, indicates a wound of the stomach or intestines.

# LECTURE XIII.

*Protrusion of a portion of the Lung during Expiration, when the Wound of the Chest is left open; Treatment of the Protrusion; Cases by Roland, Sholtt de Burano, Tulpius, Hildanus, Raysch, S. Cooper, and D'Anglois; Mr. Andrews' Case of extensive Injury to the Chest; Description of a Preparation in the Museum of the College of Surgeons;* WOUNDS OF THE INTERCOSTAL AND INTERNAL MAMMARY ARTERIES; *Hemorrhage rarely occurs from Wounds of these Arteries; M. Goyraud's Operation for Ligature of the Internal Mammary, when Wounded; Baron Larrey's Case; Treatment of Wounded Intercostal Arteries; Ravaton on Wounds of the Intercostal Arteries; Mayer on the Means for Suppressing Hemorrhage from those Vessels; Difficulty of doing so, when the Parts are Unsound, and the Hemorrhage Secondary; Case of Gen. Sir George Walker; Mr. S. Cooper's Case; Dr. Graff's Case; Case of Wound of the Intercostal Artery, the Hemorrhage Suppressed without the Ligature;* WOUNDS OF THE HEAD AND NECK; *Ligature of the Main Artery, when a Branch is Wounded; Danger of Tying an Artery at a distance; M. Breschet's Case; Treatment of Cut Throat; Gunshot Wounds of the Neck; Treatment of Incised Wounds of the Face; of Incised or Lacerated Wounds of the Eyelids and Brows; of the Eyes, Nose, and Ears; Injuries from Musket Balls; Case of Capt. Fritz; Hildanus' Case of Wound of the Superior Maxillary Bone, part of the Sword Sheath remaining in the Wound; Cannon-shot Injuries of the Face; Case of extensive Wound of the Face by a Piece of Shell; Distressing Results from Wounds of the Face from Musket Balls; Consequent Amaurosis; Penetrating Wounds implicating the Bones of the Face; Salivary Fistula; Wound of the Parotid Gland; of the Lacrymal Bones or Sac; of the Upper Jaw; General Sir Colin Halket's Case; Wounds of the Lower Jaw, and their Treatment; M. Baudens' Cases; Case of Col. Carleton; Wounds of the Eye from Shot; Lodging of a Ball behind the Eye, and its Consequences.*

A portion of lung will sometimes protrude during the efforts made by the sufferer to breathe, particularly in expiration, when the wound is left open, and is sufficiently loose to admit of it. When protruded it sometimes happens that the efforts of nature are not sufficient for its retraction, and it remains filling up the opening into the thorax. I have never seen a large portion of lung protruded, except through an opening, which readily admitted of its return; but when the opening is small, the return of the whole of the lung protruded has not appeared to me to be advisable, unless it should be evidently strangulated, a state which rarely occurs. The surface of the lung is but little sensible, touching it causes no apparent pain, and its adhesion to the edges of the cut pleura is more advantageous than its separation from it. It should, therefore, be allowed to remain, or be so far returned, if it can be so managed, as to rest within the edges of the divided pleura, and fill up the gap made by the incision, over which the integuments should be accurately drawn and retained as directed. The adhesion of the lung to the pleura costalis arrests the inflammation, and may prevent its progress to other parts of the cavity. That the inflammation may extend further into the substance of the lung, is possible; but when the sufferers are otherwise healthy, the chance of evil from inflammation of the general cavity of the pleura, is not greater than from pneumonia. I have had several opportunities of seeing the lung protrude, both in gun-shot, as well as in incised wounds, and whenever the protruded lung has been completely returned, I have observed more inflammation follow, than where it has been allowed to remain under the precautions recommended. Three cases were brought under my notice at Brussels, after the battle of Waterloo, and were not interfered with, greatly, as I afterwards understood, to the advantage of the patients.

The protruded lung when left uncovered and unprotected, soon loses its natural brilliancy, dies quickly, and shrinks, and becomes livid, without being gangrenous, although it may become so. In such cases the protruded parts may be removed; but it should never be separated at its base from its attachment to the pleura costalis by which it is surrounded.

Roland, who practised in Bologna, in 1264, first cut off a portion of lung which had protruded; but not until he had obtained the permission of the bishop, and the certificates of the desire of the patient and thirty of his friends, that it should be done. Sholtt de Burano is said by Andre de la Cruz to have done the same thing.

Tulpius gives an account of a man who after four days had three ounces of a mortified lung removed, and recovered. Dying six years afterwards, the lung was found adhering to the pleura at the part which had been injured, but no other sign of disease. Hildanus having removed a piece by the actual cautery under similar circumstances, was not contented to allow nature to act for herself, but introduced a wooden wedge between the ribs to keep them asunder, until the remaining portion of the lung shrunk back into the chest, the patient recovering in spite of his surgeon. Raysch records another case in which the portion of protruded lung was removed by mistake, nevertheless the man escaped. Mr. S. Cooper had a case after the battle of Waterloo, in which he tied a ligature around a piece of protruded lung, and cut it off, but he learned afterwards that this man did not recover.

Case 153.—A child, thirteen years of age, fell from a height against the sharp end of the branch of a tree, and made a wound three inches in length between the fifth and sixth ribs, through which the lung protruded, having a transverse wound on its surface. The protruded portion of the lung was returned by D'Anglois with difficulty; the edges of the wound were brought together by bandages. The shock of the injury lasted three days; reaction was overcome by repeated bleedings, &c.; in six weeks the cure was complete.—*La Lancette Francaise*, April 1st, 1845.

The two following cases are given from their extraordinary nature and successful results.

Case 154.—A Prussian sailor was admitted into the London Hospital, under Mr. Andrews, Feb. 25, 1831, in consequence of having been struck down by an iron bolt, five inches and a half long, and two and a half wide, belonging to the end of a trysail yard, which was lowering, and which perforated the chest, and entered the deck for an inch, compressing his chest into a space not exceeding four inches. The bolt entered the chest between the fourth and fifth ribs of the left side, about an inch and a half from the middle of the breast bone, and came out between the eleventh and twelfth ribs, about four inches from the spine. The countenance was livid, breathing difficult, threatening suffocation, pulse irregular, and he spat up small quantities of frothy blood. After a time he rallied. This man recovered, and was convalescent on the 30th of May, or in three months. The quantity of blood spat up did not exceed that commonly coughed up in broken ribs. The discharge of pus from the wounds till they had healed, was very trifling. The pulsation of the heart was very violent, distinctly raising the bed clothes. He lost about eighty ounces of blood from the arm, and had three hundred leeches applied at different times. His mouth was sore, in eleven days after his admission, from the exhibition of calomel and opium.

Mr. Andrews gave me the opportunity of examining this man, in 1841. He was in good health; the breathing of the side injured good; the action of the heart violent, but not irregular. The depression made by the bolt and its cicatrix was so directly over the great vessels, that it must have passed between them, pushing them aside, constituting altogether one of the most remarkable cases on record; it was owing perhaps to the end of the bolt being blunt, and the great force, from the weight of the yard with which it was driven through, that the lung was but little injured.

Case 155.—In the Museum of the Royal College of Surgeons, there is a perforation of the breast bone, with the cartilage, and part of the ribs on each side attached, and a shaft of a gig, the wedge like end of which was forced in by the violence of a horse, on one side of the chest, and came out at the other, going under the breast bone; a second wound was observable lower down, made by the iron part of the shaft, for the reception of the belly band. The man recovered at the end of nine weeks, after the loss of one hundred and twenty ounces of blood, taken at different times, and lived for five years without further inconvenience than a slight loss of breath on any exertion; after that he suffered from dyspnœa and irregular action of the heart, and died nearly ten years after the accident.

*Examination*—The thorax was somewhat distorted, from an angular projection at the union of the upper and middle portions of the sternum, on each side of which was an irregular depression; on the left, and four inches and a half from the middle of the bone, the depression extended forwards three inches, along the intercostal space between the second and third ribs; on the right, at three inches distance, the depression extended backwards two inches between the same ribs. The upper cicatrix, on the left side, was behind the margin of the great pectoral muscle, and the under one an inch below it. The right cicatrix was opposite the intercostal space of the third and fourth ribs. The pectoralis major adhered to a membranous substance, occupying the place of the destroyed intercostal muscles, thin, smooth, strong, and transparent, through which the lung could be seen on the left side, but not on the right. The cartilage of the left second rib had been broken, and was only united by ligamentous substance; and the rib itself also fractured, two inches behind, had united with its inner edge turned a little into the chest; the third and fourth cartilages had been fractured, but united by bone. The right third rib had been broken. On opening the chest, the lungs were found strongly adherent, at their back part, to the pleuræ. In front, on the left side, the lung adhered to the displaced second rib, and to the membrane between the second and third ribs, the adhesions extending to the mediastinum as low as the fifth rib. Another portion of lung also adhered between the third and fourth ribs, where probably the tug iron had entered. On the right side, the lung adhered to the membrane between the ribs, to the extent of an inch and a half around its margin. The pericardium was almost entirely adherent to the heart, but not very firmly. The heart itself was larger than usual, and the cavity and fibres on the right side proportionally greater than on the left.

*Wounds of the Intercostal and Internal Mammary Arteries* have occupied so much of the attention of theoretical surgeons, and so many inventions have been broached for the suppression of hemorrhage, particularly from the former, that it becomes consolatory to know that bleeding from these vessels rarely takes place, and that the inventions are more numerous than the cases requiring them. I have never had occasion to see a distinct case of hemorrhage from an internal mammary artery, but if a bleeding should take place from a wound in its neighbourhood, and of a nature to lead to the belief that it came from this vessel, the wound should be enlarged, until the part whence the blood flows is ascertained, when if from the artery, the vessel should be twisted or secured by ligatures, and if these methods should be impracticable, the wound should be closed and the result awaited.

M. Goyraud proposed in the *Lancette Française*, for September, 1834, the following method of operating for the application of a ligature on this vessel, which should be borne in mind in all cases in which it may be supposed to be required. "The operation," he says, "may be done with ease in the three first intercostal spaces; it offers some difficulties in the fourth; is very difficult in the fifth, and is scarcely to be done lower down. An incision two inches in length is to be made near the side of the sternum from without inwards, at an angle of forty-five degrees with the axis of the body. The middle of this incision should be three or four lines distant, (a quarter of an inch) from the bone, and in the centre of the intercostal space, within which the vessel is to be found. The skin, cellular substance, and the great pectoral muscle having been divided, the external intercostal muscle, aud its aponeurosis with the muscular layers of the inner intercostal muscle are to be separated, and torn through with a director, until the artery and its two venæ comites are laid bare, at the distance of three lines from the edge of the sternum, lying before the fibres of the triangularis sterni muscle, which separates these vessels from the pleura. A bent probe, or other proper instrument, can now be readily passed under the artery." But after all, the vessel can only be secured in this way, when injured at the upper part of the chest; below this it must bleed into the cavity, unless there be an open wound.

Case 156, by Baron Larrey.—T. F. Besnier, 23 years of age, was wounded by a sword, in a duel, in 1828, which penetrated the chest, about an inch and a half on the left side, injuring the cartilage of the seventh rib at its junction with the sternum, and in all probability dividing the internal mammary artery, besides opening into the mediastinum, and the pericardium. He lost a considerable quantity of blood, and was brought to the hospital in an apparently dying state. The pulsations of the heart were indistinct, and heard as if at a distance from the wall of the chest, as in dropsy of the pericardium; the right side was distended, and the nipple on that side more elevated than that on the left; the false ribs were motionless, and there was every appearance of an extravasation of blood having taken place into the cavity of the pericardium, and the pleura of the right side. The wound did not bleed.

After many serious symptoms, giving rise to the belief that the operation for empyema would be necessary, the patient began to improve, and he at last recovered under a great number of local bloodlettings, by the application of cupping-glasses and of thirteen moxas.

*The Intercostal Artery*, although often injured, rarely gives rises to hemorrhage, so as to require a special operation for its suppression; but whenever it does occur, the wound should be enlarged so as to shew the bleeding orifice, which should be secured by one ligature if distinctly open, and by two if the vessel should only be partially divided. The vessel is sometimes so small as to be easily twisted or its end sufficiently bruised, as well as twisted, to arrest the hemorrhage.

Ravaton, on the subject of wounds of the intercostal arteries, says:—"I have dressed as many sword wounds as any surgeon who exists, and have seen many accompanied by very serious hemorrhages, although I have never been able to find the vessel which gave rise to them, and have therefore never attempted to tie or to apply styptics to an intercostal artery, from a wound of which, any where except near its origin, I do not think there is much to fear, more particularly as I have seen two ribs cut across by a sword, with a very ordinary amount of hemorrhage; and I suspect our predecessors have thought more of wounds of these arteries than they deserve, from their being more in the way of being injured than others;"—a remark which accords with the experience of modern surgeons. I have had occasion to twist and bruise the end of an artery bleeding in an intercostal space, and I have tied a vessel under the edge of a rib; but I have not met with any of the great difficulties usually said to be experienced in suppressing a hemorrhage from this vessel, when the wound was recent, and the parts were sound.

Mayer, in his *Tractatus de Vulneribus Pectoris Penetrantibus*, which is now in the library of the College of Surgeons, has enumerated some two dozen inventions for suppressing hemorrhage from an intercostal artery—from the string tied round the artery, rib and all, by Gerard, to the little pouch or ball introduced empty into the chest, by Desault, and then filled and drawn outwardly until it pressed upon the injured vessel, and closed the wound behind it.

When the parts are unsound, and the hemorrhage is a secondary one, greater difficulty is sometimes experienced in arresting it, from the ligature easily cutting its way through the softened parts, and from styptics being liable to fall into the cavity of the chest.

Case 157.—General Sir George Walker, G.C.B., after scaling the wall of Badajos, with the fifth division, on the left of the breaches assailed by the fourth and light divisions, and of the castle scaled by the third, was wounded by a slanting musket-ball, which struck the cartilages of the lower ribs of the right side, broke the bones, penetrating the chest, and then passed outwards. He remained in Badajos under my care during the first three weeks, with many of the other principal officers wounded, and got over the first inflammatory symptoms in a satisfactory manner. Staff-Surgeon Burnall informed me that after I left him the wound sloughed, some part of the cartilages separated, and one of the intercostal arteries bled; and although the bleeding was arrested, once by ligature, and afterwards, on its return, by different contrivances; each time that it reappeared, his life was placed in considerable jeopardy from it, and the discharge from the cavity of the chest, which was profuse. The bleeding was ultimately arrested permanently by the ol. terebinth., applied on a dossil of lint, and pressed on the bleeding spot by the fingers of assistants until the hemorrhage ceased. He recovered after a very tedious treatment, with a considerable flattening of the chest and a deep hollow on the lower part of the side, whence portions of the rib, and of the cartilages had been removed.

Case 158.—Mr. S. Cooper relates the case of a young gentleman, in his *Surgical Dictionary*, page 1491, seventh edition, one of whose intercostal arteries had been wounded by a penknife, about two inches from the spine. Eight ounces of blood flowed from the wound; but as the opening was small, a much larger quantity collected among the muscles of the back, and gave rise to intense pain and symptomatic fever, ending in suppuration. Nearly eight pints of fluid, consisting of pus and blood, were discharged after an incision, and the recovery of the patient was tedious.

The following case, in which death followed a wound of the intercostal artery, is valuable from other causes. It was published by Dr. Graff, of Hesse.

Case 159.—A young man, aged 15, was wounded by small-shot in the chest, between the first and second ribs, and near the sternum, at the distance of about forty-eight paces. He ran about six hundred paces and fell. He died thirty-eight hours afterwards. On opening the injured cavity of the thorax, it was found to contain twenty-eight ounces of blood, the lung being collapsed to one-fourth of its natural size. An opening on its upper part corresponded to the external one in the paries; but the track of the shot could not be traced into its substance for more than two inches and three quarters; a lacerated spot was, however, perceived at the lower edge of the sixth rib, about two inches from its head, at which part the intercostal artery was found to be torn through; the shot could not be found, and there was no opening in the skin behind.

The discussions which took place on this case led to the statement of an anatomical fact, that when a man is standing erect, a line drawn horizontally from the upper border of the second rib in front, would touch the upper edge of the fifth rib behind, and that very little inclination, viz., an inch and a half, was necessary to make the shot wound the intercostal artery of the sixth. Auscultation would have made known the extravasation, and it does not appear that the loss of blood was sufficient to destroy life, unless some other injury had been sustained, which was not perceived.

Case 160.—A. B. was wounded by a sword midway between the fourth and fifth ribs of the right side, which opened the intercostal artery, and wounded the lung for some lines in depth. When brought to the hospital, the wound was still bleeding, and by small jets of blood, apparently from the intercostal artery. Instead of tying the vessel after enlarging the wound, it was brought together by compress and bandage, without care for any hemorrhage which might take place within. Shortly afterwards the patient felt relieved, and gradually recovered under a very strict antiphlogistic treatment, the extravasated blood being absorbed.

*Wounds of the head and neck*, attended by loss of power of the extremities, from injuries done to the brain, spinal marrow, or nerves, have been already noticed, as well as those hemorrhages from the mouth and neck, dependent on the lesion of arteries, which, can, or cannot, be perceived or attained. In my Lectures on Wounds of Arteries, I have said " It is not possible in every instance to reach the wounded part of an artery, without making greater sacrifices, and without incurring greater dangers, than are consistent with that prudence and discrimination which should distinguish an accomplished surgeon. Wounds and injuries of the throat and mouth, implicating the carotid artery, furnish the most prominent examples of difficulties of this nature, and the propriety of placing a ligature on the main branch, at a distance from the part wounded under these particular circumstances, must now be considered. I have in these peculiar cases given precedence to the external carotid, when its branches are wounded, and if that should fail, then the common or primitive, or even the internal carotid."

Of the danger of tying an artery at a distance, on the supposition that it may be the trunk of the one wounded, the practice of M. Breschet, at the Hotel Dieu, furnishes an example pregnant with interest.

Case 161.—A man was wounded by a ball in the side of the neck, and suffered severely from secondary hemorrhage, some days after being brought to the hospital. Unable to arrest it, M. Breschet was about applying a ligature to the common carotid, when the man died in time to prevent it. On examination after death, the vertebral was found to be the artery wounded, between the second and third vertebræ. The ligature of the carotid, had he lived a little longer, would have been a useless addition to his misery. This case ought to be a warning to surgeons.

With respect to those wounds which are made with knives or razors, by persons attempting to destroy themselves, I shall merely remark in this place, that in all not actually superficial, there are two great principles on which they should be treated. The *first* is, not to place the parts in contact, until all hemorrhage has ceased, or the patient may be suffocated. In the mean time, a soft sponge may be placed between the edges of the cut. When the larynx or trachea is obstructed by a quantity of blood, it may be sucked out, or drawn up by an exhausting pump, and it may be necessary in some rare cases to introduce a tube. The *second* is, to keep the divided parts in contact afterwards, by position and bandage, but not by suture. If the œsophagus is wounded, nourishment should be administered by a gum elastic tube introduced through the nares even into the stomach. Ferey relates the case of a soldier wounded between the trachea and œsophagus, who passed the ball per anum on the sixteenth day, and recovered. I have seen balls remove a portion of the larynx, and of the trachea, without destroying the patient. And in one case, that of Capt. Hall, of the 43d Regt., a ball passed between the upper part of the back of the larynx, and the termination of the pharynx without causing much further inconvenience than the loss of voice. In this instance it must have been the superior laryngeal nerve that was injured, and not the recurrent, yet the voice could only be heard in a whisper, and was not completely recovered for years. If a ball should lodge in the trachea, it must be removed by the operation of laryngotomy or tracheotomy, if the original wound cannot be enlarged; although Birch, says Christopher Wren, hung up a man wounded in this way, by the heels, when the ball dropped out through the glottis, and mouth. General Sir E. Pakenham who was killed at New Orleans by a ball which went through the common iliac artery, had been twice shot through the neck in earlier life. The first shot, which went through high up, from right to left, turned his head a little to the right. The second shot, from left to right brought it straight. My kind and excellent friend had ever afterwards a great respect and regard for the doctors and the wounded. The recollection of that regard has made me sometimes think it might be advantageous for the service, if every general could be at least once shot through the neck or the body, before he was raised to the command of an army in the field.

Wounds of the face made by swords, or sharp cutting instruments, should be always retained in contact by sutures. When the cut is of small extent, and not deep, the skin only should be included by the thread in the slightest possible manner, and the part supported by adhesive plaster and bandage. When the cheek is divided into the mouth, one, two, or more sutures, may require to be inserted more deeply, but the deformity of a broad cicatrix will in general be avoided, by carefully sewing up the whole line in the manner pointed out, by taking the very edge only, and a cut in the bone or bones of the cheek should not prevent the attempt being made to unite the external wound over it.

Incised or even lacerated wounds of the eyelids and brows should be united by suture, as far as it can possibly be done in the first instance, by which a subsequent painful operation may be avoided; great care should be taken in doing this; the suture must be inserted through the eyelid, and a leaden thread is the best, the first being introduced at the very edge of the lid, and two, or as many more afterwards, as may be necessary. They may remain for four or more days, as circumstances seem to require. If the eye be wounded, any part protruding beyond the sclerotic coat should be replaced or removed; but the eye, however injured, should not be removed unless nearly detached in every direction, and destroyed; the treatment should be strictly antiphlogistic, in order to prevent suppuration of the eye-ball, which may in general be effected, if too much injury have not been done to it, and if the treatment be sufficiently decided and well continued. These observations apply to the nose and ears, and all parts not actually separated, (or if separated, for a short time only), should be replaced in the manner directed, and every attempt made to procure re-union. If this should fail, surgery may yet be able to yield assistance by replacing the piece separated from a neighbouring part—a proceeding requiring a separate consideration. Injuries from musket balls are often attended by considerable laceration, particularly when near the eye-lids, and whenever this occurs, the parts likely to adhere should be brought together by suture, the actual holes made by the ball alone excepted, after any splinters of bone which may present themselves have been removed. If the bones should be broken, not splintered, they will in all probability reunite under proper management.

One of the most curious instances of the lodgment of a foreign body, occurred in the person of Captain Fritz, at Ceylon, whose gun burst in his hand, and drove the iron breech into the forehead, whence it descended into the nares, and at the end of a year, a part made its appearance in the mouth, through the palate. He died eight years afterwards, having suffered much inconvenience from the offensive discharge it occasioned, when the iron was removed, to the astonishment of every body; it had obviously injured no part of any material importance to life. I have seen balls descend in this way into the throat and soft palate, and have removed them from both places with success, and from the hard palate with equal surprise and advantage to the patient. I have known a ball lodge in the superior maxillary sinus for months, and even years before it was removed, or before the death of the patient proved the fact. A case is recorded in the Memoirs of the Academy of Surgery of Berlin, in which a ball remained in the maxillary sinus for twenty-five years, when it fell into the mouth, and was discharged. Ravaton relates many cases not less extraordinary.

Hildanus relates the case of a man struck in the face by a sword in its sheath, which was driven into the superior maxillary bone, and on being withdrawn left the end or ferule in the wound, which being mistaken for the hole made by the end of the scabbard, was plugged and filled daily for four years, before it came away, to the great surprise of his surgeons.

When a cannon-shot strikes the face, the death of the patient usually follows, after several days of misery. M. Ribes relates the history of one melancholy case of recovery, in the twenty-ninth volume of the *Dictionnaire des Sciences Médicales.*

Case 162.—A. Louis, of the French Artillery, was struck by a piece of a shell, at the siege of Antwerp, in December, 1832, which carried away a portion of the cheek, upper lip, soft palate, and nearly the whole of the lower jaw, with the soft parts covering it. The tongue hung down for several inches over the fore part of the larynx, exposing the cavity of the throat. As digestion was little impeded when fed by a spoon placed on the face of the tongue, he gradually recovered. Dr. Forget and M. Verschuylen of Antwerp, inserted a silver apparatus to support the tongue, &c., which was most successful; an account of it is given by Sir W. Whymper, in the twelfth volume of the *Medical Gazette*, and by Sir G. Ballingall, in the fifty-seventh volume of the *Edinburgh Medical and Surgical Journal*, to which I refer.

MM. Paillard and Marx say, there are at least fifteen men in the Hotel des Invalides in Paris, wearing silver masks on the lower part of their faces, in consequence of the loss of the lower jaw.

When the lower jaw is carried away with the soft parts, leaving little but the coronoid and condyloid processes, nothing can be done, beyond aiding deglutition by some artificial assistance of the kind.

Wounds of the face from musket-balls often give rise to many distressing results. I have several times seen both eyes destroyed and sunk by one ball, with little other inconvenience to the patient; one eye sunk, the other amaurotic, and both even amaurotic, almost without a sign of injury, by balls which had passed from side to side through both orbits, behind the eyes, doing little injury to the inside of the nose. When the eye becomes amaurotic from a lesion of the first branch of the fifth pair of nerves, the pupil does not always become dilated; the iris retains its usual action, although the retina may be insensible and vision destroyed. This was well shewn in the case of Major General Sir A. Leith, who was wounded by a sword on the forehead, this nerve being divided; and I have observed it in other instances, so as to leave in my mind no doubt of the fact.

Penetrating wounds implicating the bones of the face, are always distressing; when the bones of the nose are carried away, there must always be some deformity remaining, although there is oftentimes but little suffering. When these bones are merely splintered and depressed, great pains should be taken to keep them properly elevated. If the duct of the parotid gland be implicated by an incised wound, care should be taken to divide the cheek into the mouth, if it should not have been already done, and to keep the inside wound open until the external one is closed; if a salivary fistula have formed externally from inattention, or otherwise, it must be treated according to the ordinary methods adopted in such cases. When a wound of the gland itself becomes fistulous and weeps, which is a rare occurrence, it will be best treated by actual or potential cauterisation, if moderate pressure should fail. When these wounds are of some extent they are often followed by partial paralysis, in consequence of the seventh pair of nerves being injured, and the mouth is drawn somewhat to the other side. When the lachrymal bones or sac are injured by balls or swords, the tears usually continue through life to run over, and give inconvenience, although much good may be done by early attention to the injuries of this part. Wounds injuring the upper jaw, are oftentimes followed by much suffering, and by permanent inconvenience.

Case 163.—Gen. Sir Colin Halkett, G.C.B., was wounded on the 18th June, at Waterloo, when in front of his brigade, formed in squares, for the reception of the French cavalry, by a pistol ball, fired by the officer commanding them, which struck him in the neck, and gave him great pain, but without doing much mischief; a second shot shortly afterwards wounded him in the thigh, and he was at last obliged to leave the field, towards the close of the day, by a third musket-ball, which struck him on the face, when standing sideways towards the enemy. It entered a little below the outer part of the cheek-bone, on the left side, and taking an oblique direction downwards and forwards, shattered and destroyed in its course several of the double teeth of the upper jaw, and fractured the palate from its posterior part, forwards to the front teeth. The ball then took a direction obliquely upwards, destroying the teeth of the opposite side of the upper jaw, which bone it also broke, and lodged under the fleshy part of the cheek of the opposite side. These wounds gave great pain, and until the ball was removed, the left ear was totally insensible to sound and all external impressions, although the General suffered much from distressing noises in his ear. These subsided on the removal of the ball some days afterwards.

(Signed) J. P. Tupper, M.D.

Antwerp, July, 1815.

The treatment of this wound was most painful; the extraction of several pieces of bone was necessary at different times, during the three following years, under my care, before the wounds were finally closed. Considerable derangement of health followed; the deafness remains; and the General has ever since been subjected to attacks of fullness in the head of a distressing nature, requiring careful treatment, although of late these have given him less inconvenience.

M. Baudens relates the case of a French general, possibly the opponent of Sir C. Halkett, wounded on the same day in the face by a musket-ball, which lodged in the frontal sinus, and at the end of twelve years fell into his mouth.

Wounds of the lower jaw are perhaps more common, and are certainly more troublesome than those of the upper jaw; they are more difficult of management, and for the most part end in greater deformity, unless particular care be taken to prevent it, and then only in very severe cases, by operations which were formerly not in use, but which the intrepidity of the surgeons of the present day have deprived of all their terrors. I mean the methodical division of the soft parts above, the removal of the broken pieces of bone, and the rounding off of those parts of the jaw which may remain irregular and pointed. Dupuytren was the first to recommend this mode of proceeding in comminuted fractures; and M. Baudens has given two good examples of its success during his campaigns in Algeria. In the first case the ball entered at the middle of the left cheek, and came out by the side of the spinous process of the seventh cervical vertebra. The ascending ramus of the lower jaw was broken into numerous splinters. M. Baudens divided the soft parts down to the bone, entering the straight bistoury four lines, or the third of an inch below the articulation of the jaw with the temporal bone, and carried it downwards, and a little obliquely forwards, so as to terminate it in the fibres of the masseter muscle, and about half an inch below the base of the bone. This incision was begun below the seventh pair of nerves, and exposed the parotid gland divided vertically at its middle part. The splinters were removed, a part of the pterygoideus internus muscle was divided, and a projecting point of bone attached to it sawn off. He then separated the attachments of the buccinator, temporal, and pterygoideus externus muscles, divided the ligaments, and removed the coronoid and articulating processes, taking care to avoid the fifth and seventh pairs of nerves. The bleeding from two arteries was suppressed by twisting their ends; and the parts were afterwards brought together by sutures, which remained for eight days. A month after the operation the patient ate solid food, and in six weeks was cured. In the second case, the ball entered near the left commissure of the lip, and came out behind on the side of the middle of the neck; three inches of the jaw were splintered, the ends of the bone being sharp and angular. In order to remove the splinters, and to prevent the evils anticipated, M. Baudens divided the lip from the angle downwards and outwards, below the base of the bone, and as far back as the edge of the masseter muscle. He then separated the flaps, and sawed the jaw across, first near the symphysis, and then behind, outside the attachment of the masseter. The facial artery was twisted, four sutures were inserted, and the jaw duly supported. The patient was bled twice, and in six weeks was cured; at the end of that time he could eat solid food. In the first case in which the articulating process, as well as the ascending ramus was removed, it required only fourteen days before he could eat. Perhaps the removal of the coronoid and condyloid processes was not absolutely necessary; the bone might have been cut off, by the strong spring-scissors now used for this purpose.—G.

Case 164.—Colonel Carleton, wounded at the assault of Bergen-op-zoom, was an instance of a ball fracturing the jaw directly through its body, near where the masseter muscle is attached on both sides; the jaw was in three pieces, besides splinters; several teeth were knocked out, and the tongue very much hurt. By removing the splinters both from within and without, and by cleansing and supporting the parts with great care, he recovered after a length of time only, it is true; but after all, perhaps, in a better condition than he would have been in, it the anterior third of the jaw had been removed by operation, although the deformity and the suffering after such an operation is much less than might be expected.

Wounds of the eye from shot, are remediable when these small bodies lodge in the cornea or sclerotica, whence they may be removed by any sharp pointed instrument. When a shot, or piece of a copper cap is driven through the cornea into the iris, or lies in the anterior chamber, it should be removed by an incision to the extent of about one fourth or fifth of the cornea, near its junction with the sclerotica, but in these cases, a cataract, if not amaurosis, frequently results. When the shot passes through all the coats of the eye, it can neither be seen, nor removed, with safety; vision will be lost, much pain may be endured, and the eye will frequently be lost by suppuration, or by a gradual softening, and ultimate diminution in size. A contused wound from a large shot which only injures the coats of the eye, but does not perforate them, will oftentimes be cured by a proper antiphlogistic treatment, which in all cases should be most strictly enforced, although the loss of sight is a frequent consequence after such injuries.

When a ball lodges behind the eye, it usually causes protrusion, inflammation, and suppuration of that organ; if it be not discovered by the usual means, its lodgment may be suspected from the gradual protrusion and swelling of the eye itself. If it be discovered, it should be removed together with the eye, if such proceeding be necessary for its exposure. If suppuration have commenced in the eye, a deep incision through the organ will arrest, if not prevent, the horrible sufferings about to take place, if they have not occurred, and allow the removal of the offending cause. It is of importance to prevent this state, which leads to the loss of the whole of the organ, rendering the application of a false eye useless, and materially distressing the sufferer, whereas if the back part of the eye be left with the muscles attached to it, a stump remains, against which an artificial eye may be fitted, so as sometimes to render the loss of the natural one almost unobservable.

THE END